Central Inverter

# **SUNNY CENTRAL** 400HE / 500HE / 630HE

**User Manual**

SC4-63HE-BEN100872 | 98-4008272 | Version 7.2

EN

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# 1 Notes on this Manual

This manual describes the operation and troubleshooting of the Sunny Central with the aid of the Sunny Central Control. Store all accompanying documentation in the direct vicinity of the Sunny Central. This must be available to operators and maintenance staff at all times.

## 1.1 Scope of Validity

This manual applies to the following device types with a Sunny Central Control 03, starting with firmware version 2.06.

- 400HE (SC 400HE-11)
- 500HE (SC 500HE-11)
- 630HE (SC 630HE-11)

## 1.2 Target Group

This manual is for installers and operators of a PV system equipped with a Sunny Central.

## 1.3 Additional Information

All manuals for the Sunny Central as well as for the installed components must be stored together with the plant documentation and must be accessible at all times. The documents listed below are included in the scope of delivery for your Sunny Central.

The following information is contained in these documents:

| | |
|---|---|
| **Installation Guide** | Setup and installation of the Sunny Central |
| **User Manual** | How to operate the Sunny Central and Sunny Central Control |
| **Maintenance Manual** | Maintenance of the Sunny Central |
| **Wiring Diagrams** | Wiring diagrams of the Sunny Central |
| **Accessory Documentation** | The documentation for optional accessories or optional equipment for the Sunny Central (e.g. GFDI) can be found online at www.SMA.de/en. |

## 1.4 Symbols Used

The following types of safety instructions and general information are used in this manual:

**DANGER!**

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING!**

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION!**

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

**NOTICE!**

NOTICE indicates a situation that can result in property damage if not avoided.

**Information**

Information provides tips that are valuable for the optimal installation and operation of your product.

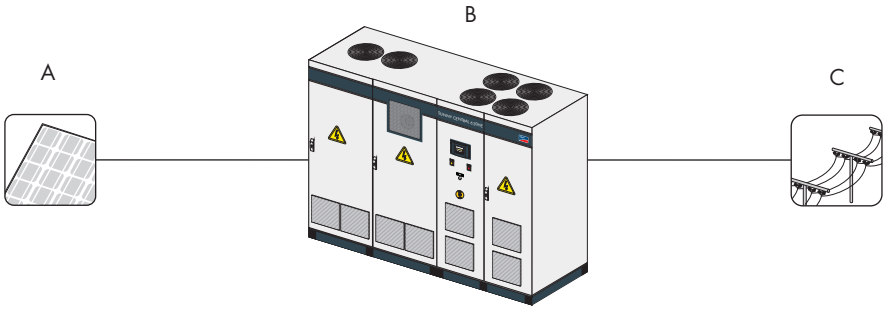
# 2 Safety

## 2.1 Appropriate Usage

The Sunny Central is a PV inverter. It allows photovoltaic solar energy from PV modules to be converted and fed into a medium-voltage grid.

The Sunny Centrals 400HE, 500HE and 630HE are equipped with the new grid safety management function. Further information on grid safety management is provided in section 3 "Grid Safety Management" (page 14).

### Principle of a grid-connected PV system with a Sunny Central




| Object | description |
|---|---|
| A | PV-Modules |
| B | Sunny Central |
| C | public grid |

### Sunny Central HE

The Sunny Central HE does not have its own low-voltage transformer. It requires an adapted external medium-voltage transformer via which it can feed into the grid.

### Sunny Central MV

The MV stations are medium-voltage stations. In an MV station, up to 2 Sunny Central HE devices can feed into the medium-voltage grid via a shared medium-voltage transformer.

## 2.2 Safety Instructions

**DANGER!**

**Risk of death when live parts of the low-voltage grid are touched. Death or serious burns.**

- Do not touch live components of the Sunny Central or the low-voltage utility.
- All applicable safety requirements regarding the low-voltage utility must be observed.

**DANGER!**

**Danger to life due to high voltages in the Sunny Central! Death or serious burns.**

- All work on the Sunny Central must be carried out by qualified personnel.
- Work on the Sunny Central must only be carried out as described in this manual.
- Comply with all the listed safety instructions.
- All the safety instructions in the Sunny Central Installation Guide must be observed.

**DANGER!**

**Danger to life due to damage to the Sunny Central. Death or serious burns.**

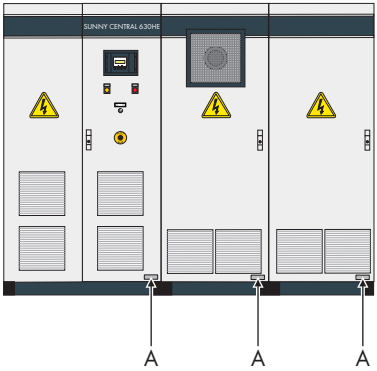
Damage to the Sunny Central, e.g. defective cables, or a damaged enclosure, can lead to death by electric shock or fire.

- Only operate the Sunny Central when it is in a technically faultless and safe condition.
- Never operate a damaged Sunny Central.
- Check the Sunny Central regularly for visible damage.
- Regularly ensure that all external safety features are freely accessible at all times, and that they function correctly.

## 2.3 Identifying the Sunny Central

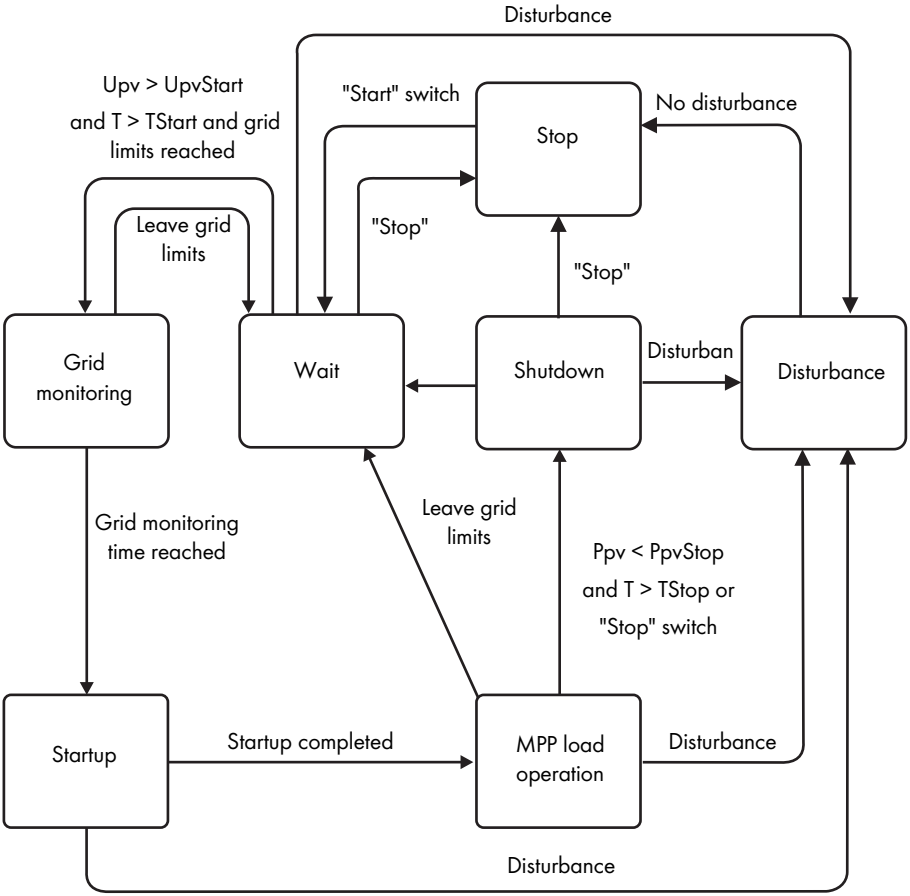
Identify the Sunny Central by the serial number (Serial No.) and the device type (Type) on the type label. The type label is situated on the inside of the door.

In addition, the serial number (A) is located on the front side of the Sunny Central.



## 2.4 Operation Conditions

When switched on, the Sunny Central passes through different conditions as depicted in the illustration below. When switched off, the Sunny Central is in the "Stop" operation condition. By turning the key switch, the Sunny Central changes to the "Wait" operation condition.



## Explanation of the Operation Conditions

**Stop:** The Sunny Central is switched off. The Sunny Central remains in this condition until the key switch is turned to "Start".

**Wait:** If the key switch is set to "Start", the Sunny Central changes to the "Wait" condition.

The start voltage VpvStart must be adjusted to conform to the PV generator which is connected to the Sunny Central. Check and adjust the start voltage as necessary.

If the input voltage is below the set start voltage "UpvStart", the Sunny Central remains in the "Wait" condition. The value for "UpvStart" is shown in the Sunny Central Control's display.

If the input voltage is above the start voltage "UpvStart", the Sunny Central waits until the time defined by the parameter "T-Start" has passed. If the input voltage has not fallen below the start voltage "UpvStart" during this period, the Sunny Central checks whether there is connection to the AC grid. If there is a valid AC grid connection the AC contactor is closed and the Sunny Central changes to grid monitoring.

**Grid Monitoring:** The grid is monitored during the monitoring time "GriGrdMonTm" for compliance with the grid limits. If the grid limits are not exceeded during this time, the Sunny Central changes to the operation condition "Startup".

**Startup:** After completing grid monitoring, the Sunny Central navigates to its first operating point and starts feeding the grid.

**MPP Load Operation:** In MPP operation, the Sunny Central feeds into the grid and works permanently at the maximum power point (MPP).

**Shutdown:** The Sunny Central shuts down (switches off) in the following cases:

- The power measured during the interval "TStop" is less than "PpvStop".
- A disturbance has occurred that requires the shutdown of the Sunny Central.
- The key switch is set to "Stop".

**Disturbance:** If a disturbance occurs during operation, the Sunny Central shuts down and the Sunny Central Control displays the disturbance. You will find a list of disturbances in section 17 "Troubleshooting and Problem Solving" (page 84).

# 3 Grid Safety Management

## 3.1 What is Required?

In Germany, PV systems with more than 100 kWp connected power must be integrated into the feeding and grid safety management. First and foremost, the utility operator must be able to limit the power of the PV system by remote control and temporarily reduce it to zero in critical cases. Relevant control commands from the utility operator must therefore be transmitted quickly and reliably to the Sunny Central.

### The Requirements in Detail

- Reception of the setpoint via a centralized ripple control signal receiver with 2 or 4 relays.
- Limitation of the feed-in power in 4 configurable stages (for example 0 % / 30 % / 60 % / 100 % of the agreed connected effective power $P_{AV}$).
- Setting the required setpoint within one minute.

## 3.2 Effective Power Limitation

Under certain circumstances the grid operator is entitled to require a temporary limitation of feed-in power or to implement a system shutdown. According to the Medium Voltage Directive, generator systems must be able to reduce their effective power in stages of no more than 10 % of the agreed connected effective power $P_{AV}$. However, the 4 staged reductions of 100 %, 60 %, 30 % and 0 % of the connected system power have become standard practice.

## 3.3 Reactive Power Setpoint

In the case of effective power output, the utility operator will generally specify a fixed setpoint for the reactive power setting. In most cases the supply of pure effective power is agreed to be cos φ near 1. However, in future it may also be necessary to be able to specify a variable, configurable setpoint in the transfer station, via a telecontrol system (or other control technology).

The setpoint can be one of the following:

- a fixed shift factor cos φ
- a shift factor cos φ (P)
- a fixed reactive power in kVar
- a reactive power/voltage characteristic Q(U)

The reactive power of the generator system must therefore be configurable. It must be possible to run through the agreed reactive power range within a few seconds and whenever this is necessary.

## 3.4 The Solution from SMA Solar Technology AG

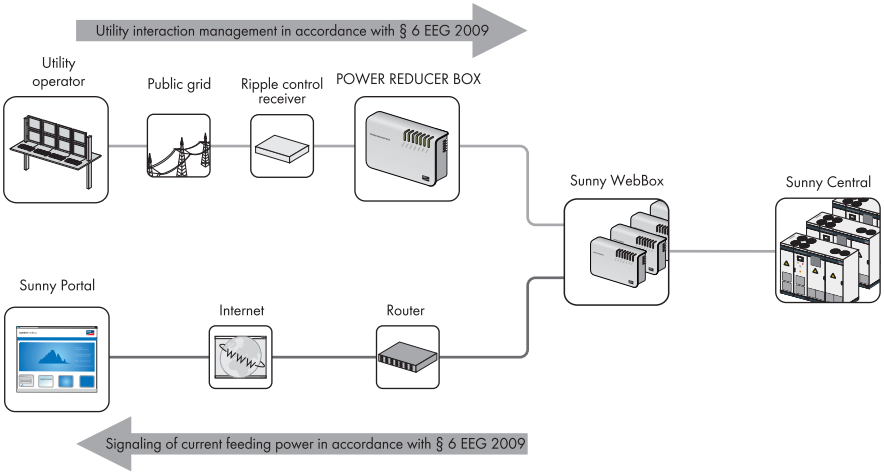
With the Power Reducer Box it is possible to implement effective power limitation or reactive power setpoint in accordance with the requirements of the grid safety management (GSM) for a PV system.

To do this, 4 digital states (e.g. of a radio ripple control receiver) can be imported via the the Power Reducer Box, thus enabling the Sunny Central inverters to be set according to the specifications of the utility operator.

The 4 input ports are freely configurable via the integrated web interface. If a signal from the radio ripple control receiver is present, the Power Reducer Box analyzes the signal and relays an instruction via the Ethernet network to the registered Sunny WebBox devices.

Activated Sunny WebBox devices transfer the command to the connected Sunny Central.

Events are recorded onto the internal memory of the Power Reducer Box. Additionally it is possible to write events onto an SD card or download events via the Web interface.



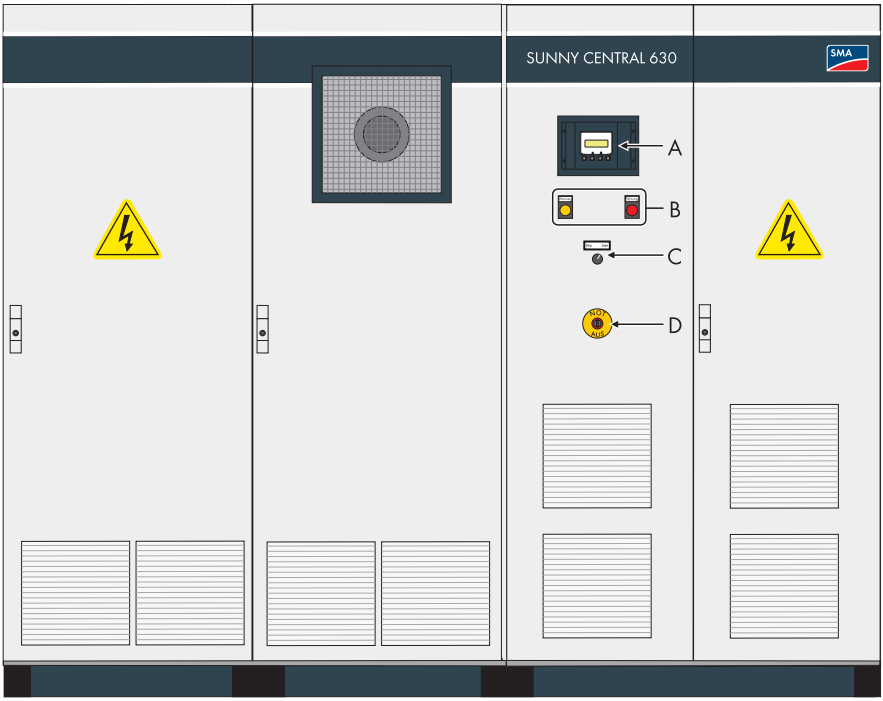

Besides the Power Reducer Box, there are 2 further options for meeting the requirement of grid security management. These are receiving the signals via 2 analog inputs on the Sunny Central and manually setting the parameter specifications.

How to implement these options is described in this manual.

# 4 Control Elements

## 4.1 Overview

The following illustration shows the different control elements, based on the example of a Sunny Central 630HE.




| Object | description |
|---|---|
| A | Sunny Central Control |
| B | indicator light (Disturbance, Warning) |
| C | key switch |
| D | emergency stop switch with key |

# 4.2 Sunny Central

## 4.2.1 Indicator Lights

There are 2 indicator lights on the front of the Sunny Central. If there is an error, these indicator lights indicate the type of disturbance.

### Meaning of the colors

**Yellow:** The Sunny Central is in "Alert" status. The Sunny Central does not switch itself off. Check the system. If the error is no longer present, the fault indication is automatically reset.

**Red:** The Sunny Central is in the "Disturbance" status. If the Sunny Central has detected a disturbance, it shuts down. Once the error has been rectified and confirmed, operation resumes. For more information, see section 17.1.2 "Types of Disturbances and Warnings" (page 85).

## 4.2.2 Key switch

The key switch is used to switch the Sunny Central on and off. After turning the switch to the "Start" position the Sunny Central changes from the "Stop" condition to the "Wait" condition. With sufficient irradiation and a valid grid, the Sunny Central changes to grid feeding operation. If the irradiation, and thus the input voltage, are too low, the Sunny Central remains in the "Wait" condition.

If the key switch is turned to "Stop", the DC main switch is automatically switched off by a motor drive.

## 4.2.3 Emergency Stop

**NOTICE!**

**Improper use of the emergency stop may cause damage to the Sunny Central.**

The Sunny Central's components are subject to considerable stress if the emergency shut-off switch is used under load. Frequent use of the emergency stop could cause individual components to become damaged as the result of heavy operational demands.

- Use the emergency stop only in the event of a real emergency.
- Switch off the Sunny Central with the key switch.

The emergency stop switch disconnects the Sunny Central from the grid and the PV generator immediately and brings the Sunny Central into a safe condition.

By pressing the emergency shut-off switch it is locked in the "Off" position. The emergency stop switch can be unlocked only with the associated key. In addition, the actuation of the emergency stop switch must be confirmed on the Sunny Central Control or with the Sunny Data Control.

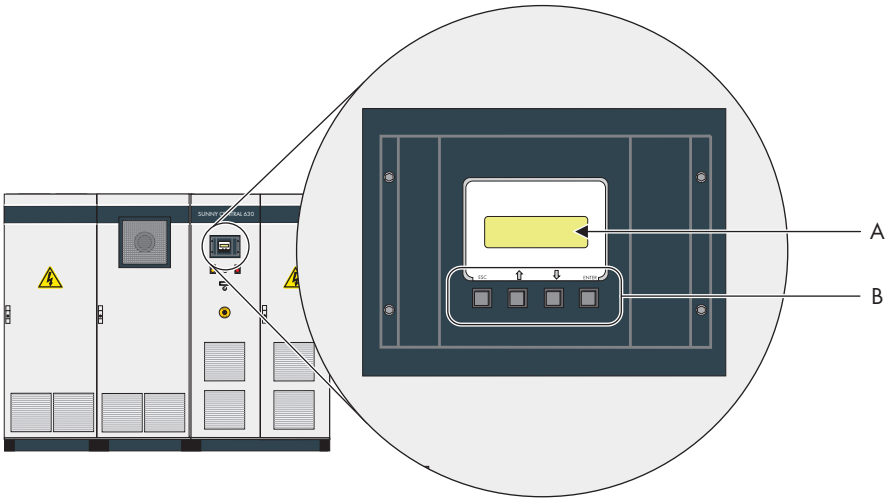
You can connect an external emergency stop switch in the Sunny Central. If several Sunny Centrals are operated in one system, they must all be switched off when one emergency shut-off switch is activated (creation of an emergency shut-off circuit). You will find more detailed information in the Installation Guide provided.

## 4.3 Sunny Central Control

Sunny Central settings can be adjusted by means of the Sunny Central Control. The functions that the Sunny Central Control performs can be grouped into the following areas:

- Operation control of the Sunny Central
- Display of the current measured values
- Changing the parameters of the Sunny Central
- Maximum power point tracking
- Detection and archiving of measurement data
- Remote access capability with NET Piggy-Back
- Connection of external sensors

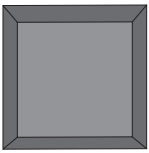
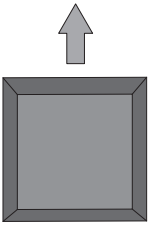
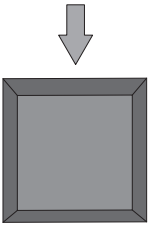
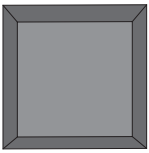
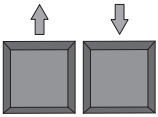
The Sunny Central Control is mounted at eye level on the Sunny Central. The Sunny Central Control is operated by means of the 4 buttons beneath the four-line display. The control buttons are situated below the 4-line display.




| Object | description |
|---|---|
| A | 4-line display |
| B | control buttons |

## 4.3.1 Functions of the Control Buttons

The control buttons have several functions. The buttons and their functions are described in the following table.

| Button | description / function |
|---|---|
| ESC  | ESC<br>• cancels / exits function<br>• answers questions with "No"<br>• returns to the previous menu<br>• changes from the standard view to the main menu |
|  | upward arrow<br>• moves to line above<br>• increases value |
|  | downward arrow<br>• moves to line below<br>• decreases value |
| ENTER  | ENTER<br>• selects a function from the menu<br>• selects values<br>• confirms changes<br>• answers questions with "Yes" |
|  | upward arrow + downward arrow<br>• returns to standard view |

## 4.3.2 Description of the Display Symbols

The Sunny Central Control display has 4 lines. It uses various display symbols, which are described in the following table.

| Symbol | description |
|---|---|
| ⍊ | additional lines underneath the display |
| ⍏ | additional lines above the display |
| ⍋ | additional lines underneath and above the display |
| ⍈ | appears to the left of the currently selected line. Press [ ↑ ] or [ ↓ ] to move to another line. |
| ⍈ (lights up) | appears to the left of a value which can be changed. |
| ⍈ (blinks) | if, for example, a parameter has been changed, the arrow to the left of the active line blinks. |
| ⌛ | the Sunny Central Control is loading the next menu or saving data. |

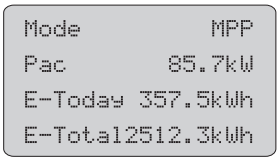
# 5 Menu

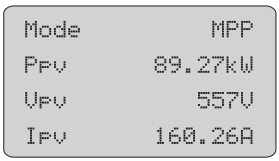
## 5.1 Display Messages during Operation

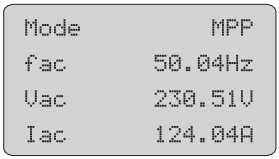
After the Sunny Central has been switched on, the Sunny Central Control initializes. Initialization involves a sequence of 3 display messages.

After initialization the Sunny Central displays the measured values and spot values shown to the right.

You can switch between the 3 views with the buttons [ ↑ ], [ ↓ ] or [ENTER]. If a warning or disturbance is reported, the display will alternate between the active standard view and the error with the highest priority.




## 5.2 Menu Overview

**Team Function Displays**

None of the Team function displays of the Sunny Central are supported.

### 5.2.1 Operating Data

| | | |
|---|---|---|
| **Faults** | Current Faults | Quit-Function |
| | DSP Error Code | |
| | BFR Error | |
| | Stack Fail No. | |
| | Stack Failure | |
| | Err Meas. DC | |
| **Plant Status** | State | |
| | Inverter Status | |
| **Energy Yield** | E-Total | |
| | E-Today | |

| | |
|---|---|
| **Data Files** | Meas. Interval |
| | Daily Values |
| | Meas.Channels |
| **Other** | h-On |
| | Working Time |
| | Startup counter |
| | Fault counter |
| | Alert counter |
| | Availability |

## 5.2.2 Spot Values

| | |
|---|---|
| **PV** | Ppv |
| | Vpv |
| | Ipv |
| **Grid** | Pac |
| | Fac |
| | Iac |
| | Vac Phase 1-2 |
| | Vac Phase 2-3 |
| | Vac Phase 3-1 |
| | Qac |
| | Sac |
| **Red.effect.pow.** | P-WSpt |
| | P-WModFailStt |
| | P-WModStt |
| **Outp.react.pow.** | Q-VArSpt |
| | Q-VArModFailStt |
| | PF-PFSpt |
| | PF-PFExtSpt |
| **Grid decoupling** | GriGrdStt |

| | |
|---|---|
| **Other** | T-Heat Sink C |
| | Mppsearchcount |
| | Team status |
| | R-Insul |
| | TmpInt C |
| | TmpExt C |
| | ExtSolP |
| | ExtSolQ |
| | ExtSolIrr |
| | ExtGloIrr |

## 5.2.3 Long-Term Data

| | |
|---|---|
| **Long-Term Data** | Meas. Chn. |
| | Energy Yield |
| | Plant Status |
| | Faults |

## 5.2.4 Device Set-up

| | | |
|---|---|---|
| **Password** | | |
| **System** | Language | German, English, spanish |
| | Date/Time | |
| | Inverter Type | |
| | Firmware | |
| | Serial Number | |
| | BFR_SW_Vers. | |
| | Service Funct. | |
| | Debug_Out | |

| | | | |
|---|---|---|---|
| **Parameters** | Param.-Function | Del Daily Value, Del Meas. Data, default chan., save parameter | |
| | Red.effect.pow. | P-Wmod, P-W, P-WNom, Pac nominal, Pac max | |
| | Outp.react.pow. | Q-VArMod, Q-VAr, Q-VArNom, Qac nominal, Qmax, PFAbsMin, PF-PF, PF-PFExt, PF-PFStr, PF-PFExtStr, PF-PFStop, PF-PFExtStop, PF-WStr, PF-WStop, Q-VDif, Q-VArGra, Q-VDifTm, Q-VRtgOfsNom | |
| | Grid decoupling | Voltage | VRtg, VCtlhhLim, VCtlhhLimTm, VCtlhLim, VCtlhLimTm, VCtllLim, VCtllLimTm, VCtlllLim, VCtlllLimTm |
| | | Grid frequency | HzRtg, HzCtlhhLim, HzCtlhhLimTm, VCtlhLim, VCtlhLimTm, VCtllLim, VCtllLimTm, VCtlllLim, VCtlllLimTm, HzCtlMin, HzCtlMinTm |
| | Grid connection | GriGrdMonTm, VCtlOpMinNom, VCtlOpMaxNom, HzCtlOpMin, HzCtlOpMax | |
| | Mpp Limit. Val. | VmppMin, dVreference, PsearchMpp, TsearchMpp | |
| | Mpp Tracking | dVtrack, TcheckMpp, Mpp Factor, TrackCnt | |
| | Start requiremt | Operating Mode, VconstSet, VpvStart, Tstart, Twait | |
| | Shut-down requ. | PpvStop, Tstop | |
| | Grid Monitor. | PpvMinCheck | |
| | Other | E-Total Offset, TMax. cabinet, TMin. cabinet, Team function (is displayed but not supported), Date availab., TmpDrtStopMod | |

| | | | |
|---|---|---|---|
| **Interfaces** | Communication | COM1:SMUs | Medium, Baudrate, Protocoll |
| | | COM2:Inverter | Medium, Baudrate, Protocoll, Registration, Detection, Parameters, Measured Values |
| | | COM3:PC | Medium, Baudrate, Protocoll |
| | Analog In | ExtSolP, R-Insul, ExtSolIrr, ExtGloIrr, ExtAlarm, ExtSolQ, TmpExt C | |
| | Digital In | Digital Input 1–8 | |
| | Digital Out | +Diag Ext+24V, +Diag DOut, Dig. Output 1–8 | |
| **Data archives** | Data Recording | | |
| | Meas. Interval | | |
| | Max. Storage | | |
| | Chan. Select. | | |
| **SMUs** | Devices | Registration, Detection, Parameters, Measured Values | |
| | Parameters | regist. SMUs, Error Report Time, Polling Time, SMU Overn. Shut, SMU Power, SMU Theft, tolerance grp1–3 | |
| | Measured Values | mean value grp1–3 | |
| | Failure | actual Failures, Hist. Failures | |
| **NET/EMAIL** | NET | KO_NET, KO_NET-ETH IP, NET-ETH SNET, KO_NET-ETH PVSN, NET-ETH GW, NET-ETH DNS | |
| | Remote-Info | EMAIL | |
| | | Events | Plant-Info, Warnings, Errors, Send at |
| | | Recipient | Company/Name, EMAIL TO, EMAIL CC1, EMAIL CC2 |
| | | Sender | Plant Name, EMAIL FROM |
| | | ISP Account | ISP Phone No., ISP User, ISP Pass |
| | | SMTP Account | SMTP Server, SMTP User, SMTP Pass, default |
| | | Test-Report | |

## 5.3 Adjusting the Display Contrast

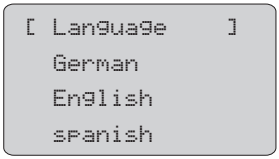
You can adjust the display contrast in any menu. You must press a combination of 2 buttons in order to increase or decrease the contrast.

| Button Combination | function |
|---|---|
| [ESC] + [ ↑ ] | increases the contrast. |
| [ESC] + [ ↓ ] | decreases the contrast. |

## 5.4 Setting the Language

You can choose between the languages German, English and Spanish. If you wish to change the set language, proceed as follows:

1. Select "Device Set-up > System > Language".




2. To select the desired language press [ENTER] twice.
   ☑ The desired language is set.

## 5.5 Changing the Date and Time

The Sunny Central Control's default settings for date and time correspond to the Central European time zone. In order to change the date or the time proceed as follows:

1. Select "Device Set-up > System > Date/Time".

2. Select the displayed date.
3. Set the required date (day, month and year ) with the [ ↑ ] or [ ↓ ] buttons and confirm each value setting with [ENTER].
4. Press [ENTER] twice to confirm the date as a whole.
   ☑ The desired date has been set.
5. Select the displayed time.
6. Set the required time (hours and minutes) with the [ ↑ ] or [ ↓ ] buttons and confirm each value setting with [ENTER].
7. Press [ENTER] twice to confirm the time as a whole.
   ☑ The desired time has been set.

☑ Date and time have been changed.

## 5.6 Entering the password

Safety-relevant Sunny Central parameters can only be adjusted upon entry of a password. You can obtain a password from our Serviceline (see section 18 "Contact" (page 97)).

Proceed as follows to enter the password:

1. Select "Device Set-up > Password".

2. Enter the password with the [ ↑ ] or [ ↓ ] buttons and confirm the set value with [ENTER].
   ☑ After confimation, the entered values are displayed as stars.

☑ The Sunny Central Control beeps 3 times if the right password has been entered. If the password is incorrect, the Sunny Central Control will beep once.

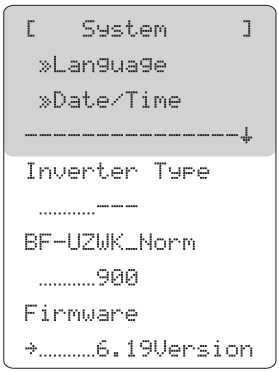
**Locking the Sunny Central Control**

You can lock the Sunny Central Control under "Device Set-up > Password", by entering an incorrect password, or no password.

Password protection will automatically resume at midnight, or upon a restart.

## 5.7 Display Firmware Version

You can view the firmware version on Sunny Central Control under "Device Set-up > System > Firmware".



## 5.8 Deleting the Daily Values of the Energy Yield

The daily values of the energy yield can be displayed on the Sunny Central Control under "Long-Term Data > Energy Yield". The daily values are sorted according to month. A list of daily energy yields is displayed upon selecting the required month by pressing [ENTER].

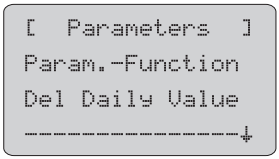
To delete the daily energy yield values, proceed as follows:

1. Select "Device Set-up > Parameters > Param.-Function".

   ☑ The display blinks.

2. Select "Del Daily Value" with the [ ↓ ] button and confirm by pressing [ENTER].

☑ The daily energy yield values are reset to the factory setting.



# 6 Measuring Channels

You can use the Sunny Central Control to display different measurement channels. To do this, proceed as described in section 6.3 "Requesting Measurement Data" (page 33).

All the measuring channels are described in the following table. The measuring channels marked with an * are preset in the factory and are displayed in the Sunny Central Control under "Long-Term Data > Meas. Chn. > SC...SCXXX" as default settings

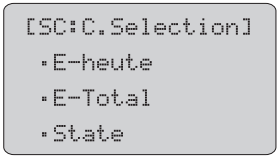
| Measuring channel | description |
|---|---|
| +Diag DOut | the measuring channel does not become visible until after the installer password has been entered. Status of the digital output "+Diag DOut" (Status: Fault, Okay) |
| +Diag Ext+24V | the measuring channel does not become visible until after the installer password has been entered. Status of the digital output "+Diag Ext+24V" (Status: Fault, Okay) |
| Startup counter | counter of the number of times the system has been started. |
| Digital Input 1 | status of digital inputs 1 to 8 |
| Digital Input 2 | |
| Digital Input 3 | |
| Digital Input 4 | |
| Digital Input 5 | |
| Digital Input 6 | |
| Digital Input 7 | |
| Digital Input 8 | |
| E-Today | energy which the Sunny Central fed into the grid on this day. This is the energy generated from the time the Sunny Central began operating in the morning to the moment of the reading. |
| Error* | error of the Sunny Central. |
| E-Total | total energy which the Sunny Central has fed into the grid during its operating time. |
| ExtGloIrr | analog input - external pyranometer (optional) |
| ExtSolIrr | analog input - external irradiation sensor (optional) |
| ExtAlarm | analog input - external alarm input |
| ExtSolP | analog input - external setpoint specification of effective power |
| ExtSolQ | this measuring channel is displayed but not supported. |
| Fac | grid frequency |
| FI-Code | response code of the NET Piggy-Back |
| FI-Status | status of the connection setup to the NET Piggy-Back |
| h-On* | total number of operating hours |
| Working Time* | total number of operating hours for feeding operations |

| Measuring channel | description |
|---|---|
| Iac | grid output current |
| Ipv* | DC input current |
| Com.Failure SMU | disturbed communication with Sunny String-Monitor No. |
| Meas. Data | counter of the number of times an entry is saved in the circular buffer. |
| mean value grp1 | mean value of the string current of Sunny String-Monitor Group 1 to Sunny String-Monitor Group 3 |
| mean value grp2 | |
| mean value grp3 | |
| State* | Sunny Central operating mode (e.g. MPP) |
| Mppsearchcount | counter for the number of times the system changed to MPP Search. |
| Pac* | grid output power of the des Sunny Central |
| Pac smoothed | smoothed grid feed-in power. |
| Ppv | DC input power of the Sunny Central |
| P-WModStt* | display of the active effective power limit. |
| Qac* | reactive power |
| regist. SMUs | number of registered Sunny String-Monitors |
| R-Insul* | insulation resistance |
| SMU Warncode | the channel "SMU Warncode" displays a number code "xxyy": xx: number of the faulty Sunny String-Monitor (1 to 40) yy: Error number 01 - 08: Channel number in the case of fault of string current monitoring 09 - 10: Fault of signaling contact monitoring |
| Fault counter | counter for the number of times a disturbance has occurred. |
| Team status | this measuring channel is not supported. |
| Cooler Temp.* | temperature of the heat sink |
| TmpExt C* | analog input of the external temperature sensor (optional) |
| TmpInt C | analog input of the internal temperature sensor (standard) |
| Tstart Cnt down | the time remaining before the system starts up. |
| Twait Cnt down | the time remaining until the next time the system tries to start up. |
| Vac Phase 1-2* | grid output voltage L1-L2 |
| Vac Phase 2-3 | grid output voltage L2-L3 |
| Vac Phase 3-1 | grid output voltage L3-L1 |
| Vpv* | DC input voltage of the Sunny Central |
| Vpv0* | open circuit voltage of the PV system |
| VpvSet | setpoint DC input voltage |
| Alert counter | counter for the number of times a warning has occurred. |

## 6.1 Adding Other Measuring Channels

You can add additional channels to the standard 14 measuring channels. To do this, proceed as follows:

1. Select "Device Set-up > Data Archive > Channel Selection > SC...SCCXXX".
   ☑ The Sunny Central Control displays all measuring channels. The measuring channels already displayed in the menu "Long-Term Data > Meas. Chn. > SC...SCXXX" are marked with a dot.




2. Select the measuring channel to be added with the [ ↓ ] button and confirm with [ENTER].
   ☑ A dot appears in front of the selected measurement channel.
3. When exiting the menu, confirm changes with [ENTER].

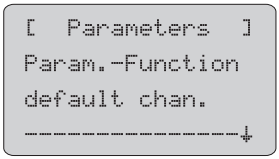
☑ Additional measurement channels have been added. To call up the measurement data, follow the steps in section 6.3 "Requesting Measurement Data" (page 33).

## 6.2 Resetting the Display of the Measuring Channels to the Factory Setting

The Sunny Central Control displays 14 measurement channels in the default settings. After you have added other channels to the display you can reset the display of the measuring channels back to the factory setting. To do this, proceed as follows:

1. Select "Device Set-up > Parameters > Param.-Function".
   ☑ The display blinks.

2. Select "default chan.".
   ☑ The display stops blinking.




3. Press [ENTER].

☑ The display of the measurement channels is reset to its factory setting.

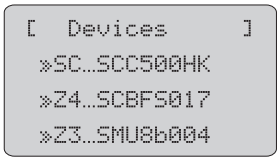
## 6.3 Requesting Measurement Data

All selected measurement channels and their measured values are recorded in the Sunny Central Control. You can request the measurement data directly from the Sunny Central Control or via the Sunny Data Control.

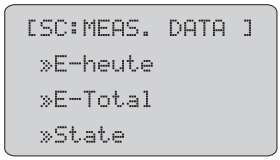
### 6.3.1 Requesting Measurement Data from the Sunny Central Control

Proceed as follows to request the measurement data directly from the Sunny Central Control.

1. Select "Long-Term Data > Meas. Chn. > SC...SCXXX".




☑ The Sunny Central Control displays the measuring channels.




2. Select the required measurement channel with the [ ↓ ] arrow button and confirm with [ENTER].
3. Select the required date with the [ ↓ ] arrow button and confirm with [ENTER].

☑ The Sunny Central Control displays the required measuring channel for the selected date.

### 6.3.2 Requesting Measurement Data via Sunny Data Control

You can request the measurement data via the Sunny Data Control. The data is compiled in a channel record.

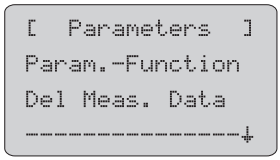
For more information on updating, refer to the Sunny Data Control manual.

## 6.4 Deleting Measurement Data

You can delete measurement data as described below:

1. Reset the measurement channels to the factory setting as described in section 6.4 "Deleting Measurement Data" (page 34).
2. Select "Device Set-up > Parameters > Param.-Function".
   ☑ The display blinks.

3. Select "Del Meas. Data".
   ☑ The display stops blinking.




4. Press [ENTER].

☑ The measurement data is deleted.

# 7 Parameters

The parameters of the Sunny Central are preset for operation. It is a good idea to adapt some of the Sunny Central's parameters to the PV generator and to the requirements of the grid safety management.

The Sunny Central's parameters are subdivided into various menus:

- Red.effect.pow.
  Parameters for effective power limit
- Outp.react.pow.
  Parameters for the reactive power specification
- Grid decoupling (disconnecting the Sunny Central from the grid)
  Parameters for grid decoupling
- Grid connection
  Parameters for grid connection
- Mpp limit values
  Limit values for MPP mode
- MPP tracking
  Settings for MPP mode
- Start requirements
  Parameters for startup of the Sunny Central
- Shut-down requirements
  Parameters for the controlled shutdown of the Sunny Central
- Grid
  Parameters for grid conditions
- Other
  Various additional functions

## 7.1 Description of the Parameter Functions

The following parameters can be found in the menus. The parameters marked with * may only be changed after consultation with SMA Solar Technology AG. Some parameters are preset by SMA Solar Technology AG and cannot be changed.

| Parameter | description of the Function |
|---|---|
| **Red.effect.pow.** | |
| P-WMod | this parameter is used to select the procedure for limiting the effective power. |
| P-W | this parameter is used to manually preset the effective power limit in kW. |
| P-WNom | this parameter is used to manually preset the effective power limit as a percentage. |
| Pac nominal | nominal effective power of the Sunny Central. |
| Smax* | maximum apparent output which the Sunny Central feeds in nominal mode into the grid. |
| Pac max* | this parameter is used to restrict the effective power. This is necessary, for example, if the feed-in power has to be limited at the grid node. |
| P-HzStop | frequency (nominal frequency + setting) for resetting the effective power limit. |
| P-HzStr | Start frequency (nominal frequency + setting ) for the effective power limit |
| P-WGra | steepness of the effective power limitation (gradient) |
| **Outp.react.pow.** | |
| Q-VArMod* | this parameter is used to select the procedure for the reactive power setpoint. |
| Q-VAr | this parameter is used to manually preset the reactive power in kVAr via the communication. |
| Q-VArNom | this parameter is used to preset the reactive power manually as a percentage via the communication. |
| Qac nominal | nominal reactive power of the Sunny Central. |
| Qmax | this parameter is used to restrict the reactive power. This is necessary, for example, if the reactive power has to be limited at the grid node. |
| PFAbsMin | restricted range of the power factor cos φ. |
| PF-PF | this parameter is used to manually set the power factor cos phi via the communication. |
| PF-PFExt | this parameter defines the excitation of the power factor cos φ. |
| PF-PFStr* | these parameters determine the power factor and the excitation at characteristic curve point 1. |
| PF-PFExtStr* | |
| PF-PFStop* | These parameters determine the power factor and the excitation at characteristic curve point 2. |
| PF-PFExtStop* | |
| PF-WStr* | this parameter specifies the feed-in power at characteristic curve point 1. |
| PF-WStop* | this parameter specifies the feed-in power at characteristic curve point 2. |

| Parameter | description of the Function |
|---|---|
| Q-Vdif* | This parameter defines the voltage change which leads to a reactive power change. This values is given as a percentage and refers to the nominal voltage "VRtg". |
| Q-VArGra* | this parameter defines the change of the reactive power setpoint at a voltage step (Q-VDif). This value is given as a percentage and refers to the nominal power "Pmax". |
| Q-VDifTm* | this parameter defines the time during which a voltage change (Q-VDif) must be present before a reactive power setpoint change (Q-VArGra) can be undertaken. |
| Q-VRtgOfsNom* | this parameter is used to change the nominal voltage of the function block. This parameter is only active when the "QVArMod" parameter is at "VArCtlCol". |
| **Grid decoupling / Voltage** | |
| VRtg | this parameter specifies the nominal line voltage of the public grid. All voltage data given as a percentage refers to this nominal voltage (100 % = VRtg). |
| VCtlhLim | threshold value for triggering at overvoltage in Level 1. |
| VCtlhLimTm | tripping time for the threshold value at overvoltage in Level 1. |
| VCtlhhLim | threshold value for triggering at overvoltage in Level 2. |
| VCtlhhLimTm | tripping time for the threshold value at overvoltage in Level 2. |
| VCtllLim | threshold value for triggering with undervoltage in Level 1. |
| VCtllLimTm | tripping time for the threshold value with undervoltage in Level 1. |
| VCtlllLim | threshold value for triggering with undervoltage in Level 2. |
| VCtlllLimTm | tripping time for the threshold value with undervoltage in Level 2. |
| VCtlMin | minimum threshold value with undervoltage in Level 3. |
| VCtlMinTm | tripping time for the minimum threshold value with undervoltage in Level 3. |
| **Grid decoupling / Grid frequency** | |
| HzRtg | nominal frequency of the energy supply grid |
| HzCtlhhLim | threshold value for triggering with overfrequency in Level 2. |
| HzCtlhhLimTm | tripping time for the threshold value with overfrequency in Level 2. |
| HzCtlhLim | threshold value for triggering with overfrequency in Level 1. |
| HzCtlhLimTm | tripping time for the threshold value with overfrequency in Level 1. |
| HzCtllLim | threshold value for triggering with underfrequency in Level 1. |
| HzCtllLimTm | tripping time for the threshold value with underfrequency in Level 1. |
| HzCtlllLim | threshold value for triggering with underfrequency in Level 2. |
| HzCtlllLimTm | tripping time for the threshold value with underfrequency in Level 2. |
| HzCtlMin | minimum threshold value for triggering with underfrequency in Level 3. |
| HzCtlMinTm | tripping time for the minimum threshold values with underfrequency in Level 3. |

| Parameter | description of the Function |
|---|---|
| **Grid connection** | |
| GriGrdMonTm | this parameter defines the time span required to meet the switch-on conditions, before the Sunny Central can be reconnected to the energy supply grid. |
| VCtlOpMinNom | this parameter determines the minimum grid voltage, as a percentage of the nominal voltage VRtg, which must be present at the Sunny Central for it to reconnect to the energy supply grid. |
| VCtlOpMaxNom | this parameter defines the maximum grid voltage, as a percentage of the nominal voltage VRtg, which may be present at the Sunny Central for it to reconnect to the energy supply grid. |
| HzCtlOpMin | this parameter determines the minimum grid frequency which must be present at the Sunny Central for it to reconnect to the energy supply grid. |
| HzCtlOpMax | this parameter defines the maximum grid frequency which may be present at the Sunny Central for it to reconnect to the energy supply grid. |
| **Mpp Limit. Val.** | |
| UmppMin * | minimum MPP voltage required for the Sunny Central to feed. |
| dVreference | MPP tracking is possible within a range equal to 2 x dVreference. As soon as the voltage exceeds or falls below this range, the inverter changes to "MPP Search" mode.<br>Default setting: 80 V<br>Recommendation for operation with thin-film modules: 120 V |
| PsearchMpp * | if the currently measured solar power drops below the value PsearchMpp for the duration of TsearchMpp, the Sunny Central begins to search for the MPP again. |
| TsearchMpp * | |
| **Mpp Tracking** | |
| dVtrack * | during MPP tracking, the inverter changes the voltage in dUtrack steps at TcheckMpp time intervals before it tracks the MPP point. |
| TcheckMpp * | |
| Mpp Factor | the start value for MPP tracking is obtained by multiplying the "Mpp Factor" parameter by the measured open circuit voltage.<br>Factory setting: 0.80<br>Recommendation for operation with thin-film modules: 0.70 |
| TrackCnt | during operation, the Sunny Central searches for the maximum power point. It checks the voltage up to seven times (default setting) in one direction, e.g. always toward the higher voltage. After the seventh time (at the latest), it also searches below the last voltage, in order to check whether the maximum power point has decreased. If, for example, the Sunny Central finds a lower power point at the time of the third increase, it searches below the most recently checked voltage. |

| Parameter | description of the Function |
|---|---|
| **Start requiremt** | |
| Operating Mode * | MPP is set as a condition for starting up the inverter. |
| VconstSet | setpoint for constant voltage operation. |
| VpvStart | Upv must be greater than UpvStart during the Tstart time, for the Sunny Central to switch from the "Wait" mode to the "Start up" mode. VpvStart must be adjusted to conform to the PV generator which is connected to the Sunny Central. |
| TStart | |
| Twait | if, in three consecutive startup attempts, PpvStop has not been exceeded, the next startup attempt will not occur before the Twait period has passed. |
| **Shut-down requ.** | |
| PpvStop * | if Ppv < PpvStop for the duration of Tstop, the Sunny Central goes into "Shutdown" mode. |
| Tstop | |
| **Grid Monitor.** | |
| PpvMinCheck * | PpvMinCheck appears only after entry of the installer password. If PpvMinCheck is set to "off", the Sunny Central continues to operate if the shutdown conditions have not yet been met. As a result, the Sunny Central operates even at night and needs to draw its operating power from the grid. |
| Grid disconnection | activation of grid disconnection |
| **Other** | |
| E-Total Offset | This parameter can be used to apply a constant offset to the energy counter in the device. It is advisable to change this parameter after replacing the Sunny Central Control. |
| TMax. cabinet* | If cabinet temperature exceeds "TMax.", the warning "Cabinet temp." will be generated. |
| TMin. cabinet* | If the cabinet temperature falls below TMin., the "Cabinet temp." warning is generated. |
| Team function | This parameter is displayed, but is not activated. |
| TmpDrtStopOfs | This parameter is used to activate or deactivate the temperature deratings. |

## 7.2 Default Parameter Settings

The essential operation control parameters are summarized in the following table. It includes the adjustable range and default value of each parameter. The adjustable range and default value depend on the Sunny Central device type.

The parameters marked with * can only be displayed / changed after the installer password has been entered (see section 5.6 "Entering the password" (page 28)).

| Parameter | area | standard |
|---|---|---|
| VmppMin* | 75 V ... 600 V | 450 V (SC 400HE-11 / SC 500HE-11)<br>500 V (SC 630HE-11) |
| dVreference* | 5 V ... 200 V | 80 V |
| PsearchMpp* | 0 W ... 25000 W | device-specific setting |
| TsearchMpp* | 60 s ... 3600 s | 600 s |
| dVtrack* | 1 V ... 10 V | 5 V / TaMp |
| TcheckMpp* | 5 s ... 60 s | 10 s |
| Mpp Factor* | 0.20 ... 1.00 | 0.80 |
| TrackCnt* | 5 ... 20 | 7 |
| VpvStart | 200 V ... 1000 V | 600 V (SC 400HE-11 / SC 500HE-11)<br>650 V (SC 630HE-11) |
| Tstart | 1 s ... 600 s | 90 s |
| Twait | 0 s ... 1800 s | 600 s |
| PpvStop | 0 W ... 10000 W | device-specific setting |
| Tstop | 60 s ... 600 s | 60 s |
| Pac max* | 1 kW ... 1000 kW | device-specific setting |
| TMax. cabinet | 30 °C ... 70 °C | 50 °C |
| TMin. cabinet | − 30 °C ... 10 °C | − 20 °C |

## 7.3 Changing Parameters

**Impaired Functionality of Sunny Central due to Altered Parameters**

Improperly altered parameters can partly or completely impair the functionality of the Sunny Central.

- Parameters marked with * may only be changed after consultation with SMA Solar Technology AG.
- After work has been carried out on the Sunny Central Control, it must be relocked, in order to prevent third parties from changing the parameters.

**Grid Parameters**

Certain parameters enable you to set values which are relevant for grid security. You must consult the SMA Serviceline before making changes to these parameters.

This chapter describes how you can adjust parameters at the Sunny Central Control. You have the option of adjusting the parameters with the following tools:

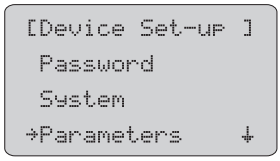
- At the Sunny Central with the Sunny Central Control.
- On site with a laptop and the Sunny Data Control software.
- From a PC via remote access with Sunny Data Control or via the Sunny WebBox.

How you can adjust parameters with Sunny Data Control or by means of the Sunny WebBox is described in the documentation from Sunny Data Control or in the documentation for the Sunny WebBox.

Note that not all parameters can be modified by remote access. Some parameters can only be modified when the Sunny Central is in the "Stop" operation condition.

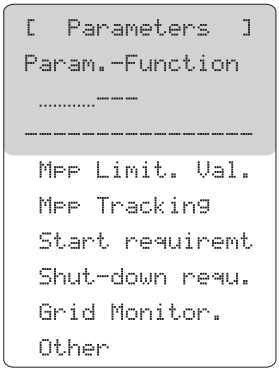
Change the parameters of the Sunny Central at the Sunny Central Control as described below:

1. Enter the password as described in Section 5.6 "Entering the password" (page 28).
2. Select "Device Set-up > Parameters".



3. Press [ENTER] to select the menu in which a parameter is to be changed.
4. Press [ENTER] to select the parameter that is to be changed.
5. Make a note of the preset value of the parameter.
6. Modify parameters after consultation with SMA Solar Technology AG.
7. Confirm the change with [ENTER].

☑ The desired parameter has been changed.



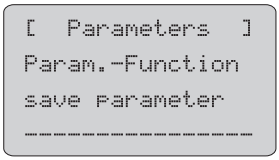

## 7.4 Resetting Parameters

To reset parameters, proceed as described in Section 7.3 "Changing Parameters" (page 41), and enter the original values of your Sunny Central.

## 7.5 Saving Parameters

After having changed the parameters save them as described below.

1. Enter the password as described in Section 5.6 "Entering the password" (page 28).
2. Select "Device Set-up > Parameters > save parameters".




3. Press [ENTER] twice.

☑ The parameters are saved.

# 8 Data Transmission

Using the "NET Piggy-Back" option, the Sunny Central Control can be monitored remotely, and can send E-mail reports concerning the status or present errors and events. Depending on your order preferences, the Sunny Central is delivered ex works with a NET Piggy-Back in one of the three following versions:

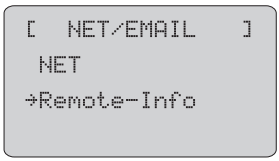
- Analog
- ISDN
- Ethernet

The connection of the Sunny Central Control to the telephone line, to a router, or to a PC, is described in the NET Piggy-Back documentation.

The Sunny Central Control is preset for the respective communication type. If you wish to receive E-mail reports, you must specify this as described in section 8.1 "Selecting Remote-Info" (page 43).

## 8.1 Selecting Remote-Info

1. Enter the password as described in Section 5.6 "Entering the password" (page 28).
2. Select "Device Set-up > NET/EMAIL > Remote-Info".




☑ The menu shown to the right appears.

## 8.2 Activating E-mail Reports

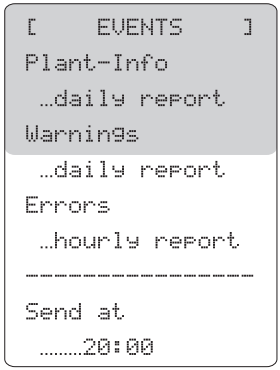
1. Select the Remote-Info as described in section 8.1 "Selecting Remote-Info" (page 43).
2. Press [ENTER].
   ☑ The line below "EMAIL" starts to blink.
3. Select "activated" with the [ ↓ ] button.

4. Press [ENTER] twice.

☑ The e-mail reports are activated.e

## 8.3 Selecting the Report Types to Send

1. Select the Remote-Info as described in section 8.1 "Selecting Remote-Info" (page 43).
2. Select "Events".
3. Select which reports should be sent at which time.




**Report Types and Setting Options**

| Report | description | adjustable |
|---|---|---|
| Plant-Info | report on the present values of your system, e.g. E-Total, E-Today. | • no report<br>• **daily report (recommended)** |
| Warnings | reports the generated warning messages. | • no report<br>• hourly report<br>• **daily report (recommended)** |
| Errors | report on the errors which have occurred. | • ro report<br>• **hourly report (recommended)**<br>• daily report |
| Events | report on the events which have occurred.<br>In addition to the report, you can have the events displayed on the Sunny Central Control in the menu under "Long-Term Data > System Status".<br>Refer to section 17.1.5 "Events" (page 95) for a description of possible events. | • no report<br>• hourly report<br>• **daily report (recommended)** |

| Report | description | adjustable |
|---|---|---|
| Send at | here the time is set at which the daily report should be sent. SMA Solar Technology AG recommends setting the time to 22:15 (10:15 pm). | • time |

## 8.3.1 Daily Report "Plant-Info"

The daily report "Plant-Info" can contain the following information:

Von: <MEINE ANLAGE>
An: <MAX@MUSTERMANN.de>
Datum: 30.04.2009 11:02
Betreff: SUNNY-MAIL FIX Ertrag: 14.00kWh / Gesamt: 13.90kWh

ABSENDER : MEINE ANLAGE

EMPFAENGER: FIRMA XYZ-SOLAR, HERR MUSTERMANN

T A G E S B E R I C H T 30.04.2009

A N L A G E N - I N F O :

| ID | GERAET | SERIENNUMMER | E-Total | E-Heute |
|---|---|---|---|---|
| SC | SCC-Test | 0139100163 | 13.90kWh | 14.00kWh |

ENDE INFORMATION

| Display | description |
|---|---|
| ID | = SC |
| GERAET | = name of the respective Sunny Central. |
| SERIENNUMMER | = serial number of the respective Sunny Central. |
| E-Total | = total energy which the Sunny Central fed into the grid during its operating time. |
| E-Heute | = energy which the Sunny Central fed into the grid on this day. This is the energy generated from the time the Sunny Central began operating in the morning to the moment of the reading. |

## 8.3.2 Hourly Report "Errors, Warnings and Events"

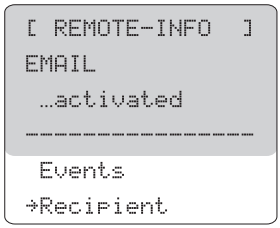
The hourly report "Errors, Warnings and Events" can contain the following information:r

```
Von:     <MEINE ANLAGE>
An:      <MAX@MUSTERMANN.de>
Datum:   30.04.2009 11:02
Betreff: SUNNY-MAIL  FIX  Fehler: 4 / Warn.: 2 / Warn.SMU: 0

ABSENDER : MEINE ANLAGE

EMPFAENGER: FIRMA XYZ-SOLAR, HERR MUSTERMANN

                 S T U N D E N B E R I C H T 30.04.2009 11:02

F E H L E R :
ID GERAET   SERIENNUMMER DATUM    ZEIT     MELDUNG
SC SCC-Test 0139100163   30.04.09 10:24   < Stoerung 400
SC SCC-Test 0139100163   30.04.09 10:24   < Stoerung 110
SC SCC-Test 0139100163   30.04.09 10:24   > Stoerung 400
SC SCC-Test 0139100163   30.04.09 10:24   > Stoerung 110

W A R N U N G (E N) :
ID GERAET   SERIENNUMMER DATUM    ZEIT     MELDUNG
SC SCC-Test 0139100163   30.04.09 11:01   > Warnung 681
SC SCC-Test 0139100163   30.04.09 11:00   < Warnung 681

E V E N T (S) :
ID GERAET   SERIENNUMMER DATUM    ZEIT     MELDUNG
SC SCC-Test 0139100163   30.04.09 11:01   > NSM
SC SCC-Test 0139100163   30.04.09 11:00   < NSM
SC SCC-Test 0139100163   30.04.09 10:59   > NSM
SC SCC-Test 0139100163   30.04.09 10:59   < NSM
SC SCC-Test 0139100163   30.04.09 10:56   > NSM
SC SCC-Test 0139100163   30.04.09 10:56   < NSM

ENDE INFORMATION
```

| Display | description |
|---|---|
| ID | = SC |
| GERAET | = name of the respective Sunny Central. |
| SERIENNUMMER | = serial number of the respective Sunny Central. |
| DATUM | = date of the error, the warning or the event |
| ZEIT | = time at which the error, warning or event was detected by the Sunny Central<br>> after the time (before the message) means that the message appeared at the specified time.<br>> after the time (before the message) means that the message disappeared at the specified time. |
| MELDUNG | = number of the fault, warning or name of the event<br>For more information on error or fault messages see section 17 "Troubleshooting and Problem Solving" (page 84). |

## 8.4 Entering or Changing an E-mail Address

1. Select the Remote-Info as described in section 8.1 "Selecting Remote-Info" (page 43).
2. Select "Recipient".

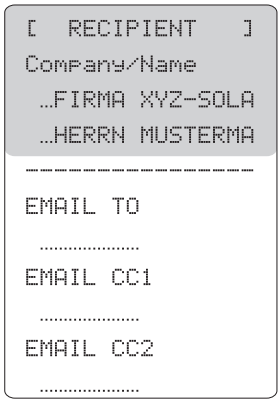



3. Enter a company name in the top line "FIRMA XYZ-SOLA" and confirm with [ENTER].
4. Enter your name in line 2 "HERRN MUSTERMA" and confirm with [ENTER].
5. Enter your E-mail address in the 3rd line "EMAIL TO" and confirm with [ENTER].

   In line four "EMAIL CC1" and line five "EMAIL CC2", you can enter two additional E-mail addresses to send reports to.

6. Confirm addresses with [ENTER].

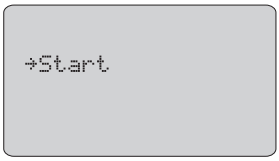
☑ The E-mail addresses are entered.



## 8.5 Sending a Test Report

1. Select the Remote-Info as described in section 8.1 "Selecting Remote-Info" (page 43).
2. Select "Test Report".

   ☑ "Start" appears in the display of Sunny Central Control.

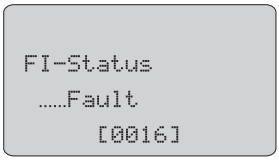



3. Press [ENTER] to send a test report.

☑ The test report is sent.

**Or**

☑ The test report could not be sent. The message shown to the right is displayed. The meaning of the error code in the bottom line is described in the NET Piggy-Back manual.



# 9 Analog Inputs

## Analog Sensors

In the Sunny Central it is possible to install 2 sensors (ExtSolIrr, ExtGloIrr) on the Sunny Central Control via the customer's terminal strip. See the table below for the respective connection options available for the customer. These sensors can be configured by the customer.

## External Signals

In addition to the analog sensors, 3 further signals can be connected: ExtAlarm, ExtSolP and ExtSolQ. These signals have a direct effect on the operation of the Sunny Central. The analog inputs ExtSolP and ExtSolQ serve to regulate the effective and reactive power.

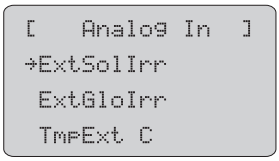
This section describes how to display the sensors on the Sunny Central Control and how to configure them. The electrical connection of the sensors is described in the Sunny Central's installation guide.

## Overview of the Analog Inputs

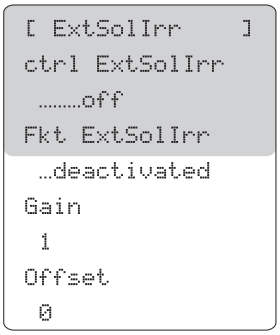
| Input | meaning |
|---|---|
| ExtSolP | external setpoint specification of effective power |
| ExtSolIrr | external irradiation sensor |
| ExtGloIrr | pyranometer (measurement of global solar irradiation) |
| ExtAlarm | external alarm input, e.g. for monitoring the functioning of the medium-voltage transformer |
| ExtSolQ | external setpoint specification of reactive power |
| TmpExt C | external temperature sensor / PT 100<br>(is factory-installed in the Sunny Central) |

## 9.1 Detecting External Sensors

1. Enter the password as described in Section 5.6 "Entering the password" (page 28).
2. Select "Device Set-up > Interfaces > Analog In".
3. Select the required analog input.




☑ A detailed view of the required analog input is displayed. The figure to the right shows the detailed view of the analog input "ExtSolIrr".



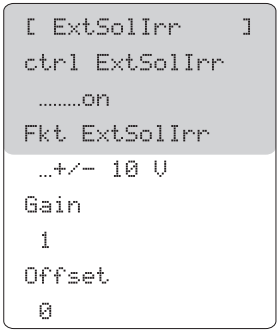
## 9.2 Calculating Gain and Offset

Calculating gain and offset using the example of "ExtSolIrr":

1. Detecting external sensors as described in section 9.1 "Detecting External Sensors" (page 51).
2. Set "ctrl ExtSolIrr" to "on" to activate the analog input for the sensor.
3. Select a measurement range for the analog sensor, e.g. "+/-10V".

   The displayed value is calculated by means of the following:

   - The value measured by the sensor.
   - The value specified as the gain.
   - The value specified as offset.




4. Calculate the gain factor and the offset.

   The gain factor is obtained by dividing the display range by the measuring range.

   **Gain Factor = Display Range / Measuring Range to be Shown**

   The offset is calculated by subtracting the product of the gain factor and the lower end of the measuring range from the lower end of the display range.

   **Offset = lower end of display range - (gain factor x lower end of measuring range)**

### Formulas

M is the measured value measured in the range from Mu to Mo

The value W is to be displayed in the value range from Wu to Wo

| | |
|---|---|
| Gain**:** | V = (Wo – Wu) / (Mo –Mu) |
| Offset: | O = Wu – (V x Mu) |
| Display on the Sunny Central Control: | W = (V x M) + O |

### Explanation of the Abbreviations Used

| | | | |
|---|---|---|---|
| M | Measured value | Mo | upper end of measuring range |
| Mu | lower end of measuring range | O | Offset |
| V | Gain | W | Value |
| Wo | upper end of value range | Wu | lower end of value range |

## Example Calculation: Pyranometer

A pyranometer has an output voltage of 0 to 10 Volt, which corresponds to an irradiation of 0 to 1350 W/m².

Mu = 0 V Mo = 10 V

Wu = 0 W/m² Wo = 1350 W/m²

| Formula | calculation |
|---|---|
| V = (Wo – Wu) / (Mo – Mu) | V = (1350 – 0) / (10 – 0) = 135 |
| O = Wu – (V * Mu) | O = 0 – (135 x 0) = 0 W/m² |

Example if M = 5 V

| Formula | calculation |
|---|---|
| W = (V x M) + OW = (V x M) + O | 135 x 5 + 0 = 675 |

## Example Calculation: Temperature Sensor

A temperature sensor puts out 4 to 20 mA through a measuring transducer. This corresponds to a temperature range of –30 to 80 °C.

Mu = 4 mA Mo = 20 mA

Wu = –30 °C Wo = 80 °C

| Formula | calculation |
|---|---|
| V = (Wo – Wu) / (Mo – Mu) | V = (80 – (–30)) / (20 – 4) = 6.875 |
| O = Wu – (V x Mu) | O = (–30) – (6.875 x 4) = –57.5 °C |

Example if M = 4 mA:

| Formula | calculation |
|---|---|
| W = (V x M) + O | 4 x 6.875 + (–57.5) = –30 |

## 9.3 Configuring External Sensors

### 9.3.1 ExtSolIrr and ExtGloIrr

1. Open the detailed view of the sensor, as described in section 9.1 "Detecting External Sensors" (page 51).
2. Activating or deactivating the external sensor.

   **ctrl ExtSolIrr, ctrl ExtGloIrr**

| Adjustable | meaning |
|---|---|
| off | sensor deactivated. |
| on | sensor activated. After the sensor has been activated, it is displayed under "Spot Values > Other". See also section 9.3.2 "Displaying Sensor Values" (page 55). |

3. Setting the function of ExtSolIrr and ExtGloIrr.

   **Fkt ExtSolIrr, Fkt ExtGloIrr**

| Adjustable | meaning |
|---|---|
| Deactivated | the analog input is deactivated |
| +/- 20 mA | current measurement -20 mA to +20 mA |
| +/- 10 mV | voltage measurement -10 mV to +10 mV |
| +/- 20 mV | voltage measurement -20 mV to +20 mV |
| +/- 50 mV | voltage measurement -50 mV to +50 mV |
| +/- 100 mV | voltage measurement -100 mV to +100 mV |
| +/- 500 mV | voltage measurement -500 mV to +500 mV |
| +/- 1 V | voltage measurement -1 V to +1 V |
| +/- 5 V | voltage measurement -5 V to +5 V |
| +/- 10 V | voltage measurement -10 V to +10 V |

☑ ExtSolIrr and ExtGloIrr have been configured.

#### Gain

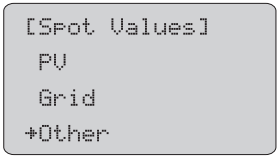
Conversion factor. See chapter 9.3.2 "Displaying Sensor Values" (page 55)

#### Offset

Value which is added. See chapter 9.3.2 "Displaying Sensor Values" (page 55)

## 9.3.2 Displaying Sensor Values

1. Select "Spot Values > Others".




2. Select the desired sensor.

☑ The present value is displayed under the sensor name.

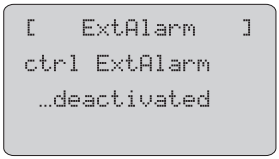
## 9.4 Configuring External Messages

## 9.4.1 Setting ExtAlarm

The analog input ExtAlarm is preconfigured for the connection of an external alarm. Activate or deactivate the monitoring as described below.

1. Open the detailed view of the sensor, as described in section 9.1 "Detecting External Sensors" (page 51).
2. Setting ExtAlarm.

   **ctrl ExtAlarm**




| Adjustable | meaning |
|---|---|
| deactivated | sensor is deactivated. |
| Active high | alarm is triggered if 24 V are present at the alarm input terminal. |
| Active low | alarm is triggered if 0 V is present at the alarm input terminal. |

**E-mail when Alarm is Triggered**

If you have activated the E-mail report "Warnings" you will receive an e-mail immediately after the alarm is triggered.

# 10 Effective Power Limitation

There are 3 different methods of limiting the effective power. You have the option of specifying a target value via the ExtSolP analog input or via a Sunny WebBox in connection with a Power Reducer Box. You can also set the limitation manually.

You further have the option of setting a frequency-dependent effective power limitation. For more details, please see section 10.2 "Effective Power Limit via Grid Frequency" (page 58).

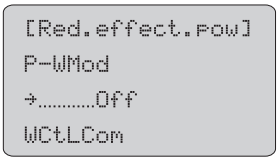
## 10.1 Procedure for Setting the Effective Power Limitation

The "P-WMod" parameter is used to select the procedure for limiting the effective power. If you need help with this, please contact the SMA Serviceline.

Proceed as follows to adjust the settings:

1. Select "Device Set-up > Parameters > Red.effect.pow. > P-WMod".

   ☑ The line below "P-WMod" starts to blink.




2. Select the required procedure for limiting the effective power with the [ ↓ ] arrow button.

   The following procedures can be selected:

| Procedure | description |
|---|---|
| off | the effective power is limited to the device nominal power "Pmax". |
| WCtlCom | the effective power limit is received via the communication by the external control unit (e.g. Power Reducer Box) and transmitted to the Sunny Central. |
| WCnst | the "P-W" parameter is set in kW via the communication (e.g. Sunny WebBox). |
| WCnstNom | the "P-WNom" parameter is set as a percentage via the communication (e.g. Sunny WebBox). |
| WCnstNomAnIn | the effective power limitation is set via a signal at the analog input ExtSolP. The analog value is converted to a target value for the power limit. |

3. Press [ENTER] twice to confirm the procedure.

☑ The desired procedure has been set for the effective power limitation.

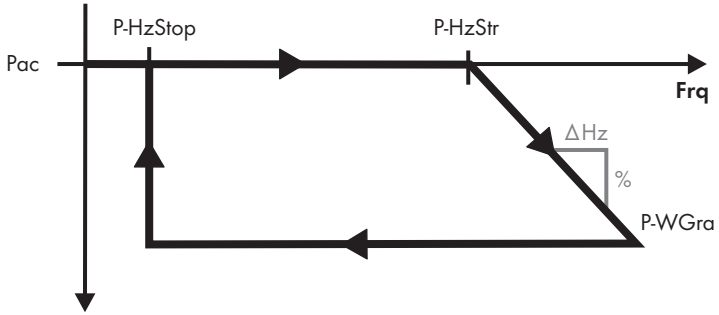
## Procedure "WCnstNomAnIn"

If you have selected the procedure "WCnstNomAnIn", you must connect a signal to the analog input "ExtSolP" of the Sunny Central. The strength of the current of the connected signal determines the nominal effective power as a percentage.

| Current | nominal effective power |
|---|---|
| 4 mA | 0 % |
| 8.5 mA | 30 % |
| 11.5 mA | 50 % |
| 13 mA | 60 % |
| 19 mA | 100 % |

## 10.2 Effective Power Limit via Grid Frequency

The downward regulation of the effective power via the grid frequency is based on the available power at the start time of the downward regulation. If the grid frequency exceeds a certain threshold which you have defined (P-HzStr), for example 50.2 Hz, the Sunny Central saves the feed-in power value at that moment in time. The saved value defines the power limit dependent on the grid frequency. The rate of rise of the limit can be set via the P-WGra parameter (Standard = 40 %). Should the grid frequency drop, the last attained power limit remains in effect. An increase in the feed-in power is only permissible with drops of, for example, 50.05 Hz(P-HzStop).




A Sunny Central with 500 kW is presently feeding 350 kW ($P_{mom}$) into the public grid. The frequency increases thereby up to 51.2 Hz. A reduction in the effective power by 40 % of the most recently available power $P_{mom}$ (350 kW) is achieved by multiplying the difference between the momentary grid frequency and P-HzStr (51.2 Hz - 50.2 Hz) with the gradient P-WGra (40 %). This results in a power limitation of 140 kW and a maximum effective power of 210 kW.

**Formula:** $P_{Grenz} = P_{mom} - ( ( (f_{Netz} - \text{P-HzStr}) / \text{Hz}) * \text{P-WGra} * P_{mom} )$

$P_{Grenz}$ = power limit

$P_{mom}$ = momentary power

**Calculation as an Example:**

210 kW = 350 kW – ( (51.2 – 50.2) * 40 % * 350 kW )

**Deactivating the Effective Power Limit via the Grid Frequency**

If you wish to deactivate the effective power limit via the grid frequency, please consult the SMA Serviceline.

# 11 Apparent Output Limitation

The Sunny Central is designed for maximum apparent output, which it must maintain even while providing reactive power. The maximum apparent output of the Sunny Central is factory-set with the "Smax" parameter.

The Sunny Central limits its apparent output in accordance with ambient temperature or current grid voltage. The Sunny Central reduces the maximum permissible apparent output with high ambient temperatures or low grid voltages.

The limitation of the apparent output on the basis of ambient temperature is factory-activated with the parameter "TmpDrtStopMod".

If the Sunny Central provides so much reactive power that the maximum apparent power limitation is exceeded, then this could result in a reduction of effective power.

**NOTICE!**

**Destruction of the Sunny Central through Alteration of the Limit Values.**

The limit values are factory-set, depending on the device type.

- Never alter the limit values on the Sunny Central.

# 12 Reactive Power Setpoint

There are 3 different methods of setting the reactive power setpoint. You have the option of specifying a setpoint via the ExtSolQ analog input or via a Sunny WebBox in connection with a Power Reducer Box. You can also set the limitation manually.

## 12.1 Procedure for Setting the Reactive Power Setpoint

The "Q-VArMod" parameter is used to select the procedure for setting the reactive power setpoint. If you need help with this, please contact the SMA Serviceline.

Proceed as follows to adjust the settings:

1. Select "Device Set-up > Parameters > Outp.react.pow. > Q-VArMod".
   ☑ The line below "Q-VArMod" starts to blink.

2. Select the required procedure for setting the reactive power setpoint with the [ ↓ ] arrow button.

   The following procedures can be selected:

| Adjustable | meaning |
|---|---|
| off | the reactive power is set to the default value Cos ϕ = 1 and Q = 0 kVAr. |
| VArCtlCom | the reactive power setpoint is received via the communication by the Power Reducer Box) and transmitted to the Sunny Central. |
| PFCtlCom | a power factor and the excitation on the Sunny Central is transmitted via the Power Reducer Box. |
| VArCnst | the "Q-VAr" parameter is set in kVAr via the Sunny WebBox or via Sunny Data Control. |
| VArCnstNom | the "Q-VArNom" parameter is set as a percentage, with respect to the nominal effective power, via the Sunny WebBox or via Sunny Data. |
| VArCnstNomAnIn | the reactive power setpoint is received via the control unit at the "ExtSolQ" analog input. The analog value is converted to a setpoint for the reactive power setpoint. |
| PFCnst | the "PF-PF" and "PF-PFExt" parameters are defined via the communication. |
| PFCnstAnIn | the power factor setpoint is received via the control unit at the "ExtSolQ" analog input. |
| PFCtlW | CosPhi is set dependent on the feed-in power. |
| VArCtlVol | the reactive power is set dependent on the grid voltage. |

3. Press [ENTER] twice to confirm the procedure.

☑ The required procedure for the reactive power setpoint is set.

### Procedure "VArCnstNomAnIn"

If you have selected the procedure "VArCnstNomAnIn", you must connect a signal to the analog input "ExtSolQ" of the Sunny Central. The strength of the current of the connected signal determines the reactive power.

| Current | description |
|---|---|
| 4 mA | Q = –100 % * Pac max (maximum –Qmax) |
| 11.5 mA | Q = 0 |
| 19 mA | Q = +100 % * Pac max (maximum +Qmax) |

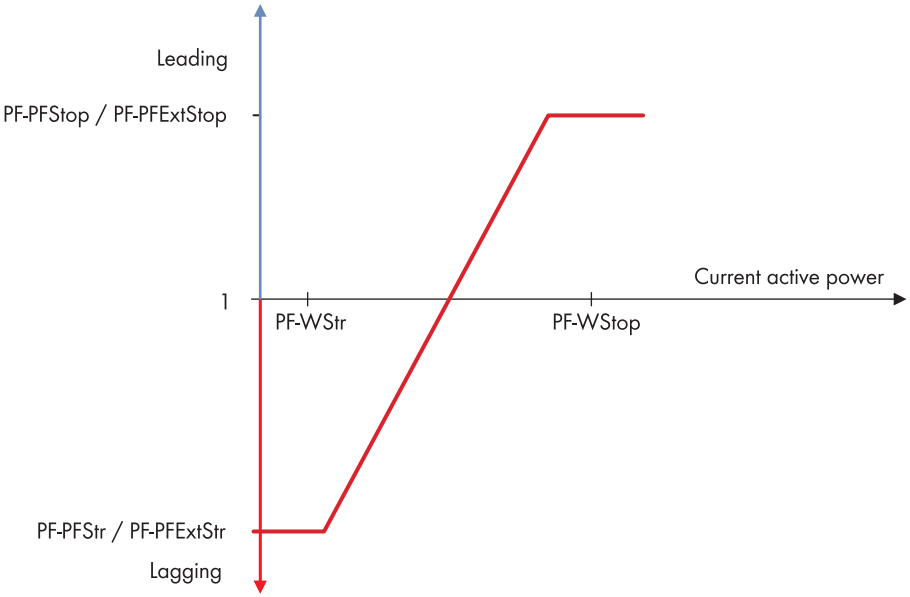
### Procedure "PFCnstAnIn"

If you have selected the procedure "PFCnstAnIn", you must connect a signal to the analog input "ExtSolQ" of the Sunny Central. The strength of the current of the connected signal determines the power factor cos ϕ.

| Current | description |
|---|---|
| 4 mA | cos ϕ = –PFAbsMin |
| 11.5 mA | cos ϕ = 1 |
| 19 mA | cos ϕ = +PFAbsMin |

## 12.2 Power Factor cos ϕ Dependent on the Effective Power at the Time

On the basis of a linear characteristic curve with an upper and lower limit, a power factor (cos phi) can be regulated dependent on the effective feed-in power at the time. The starting and end points of the characteristic curve can be set via parameters. The course of the characteristic curve is determined by the setting of the starting and end points.

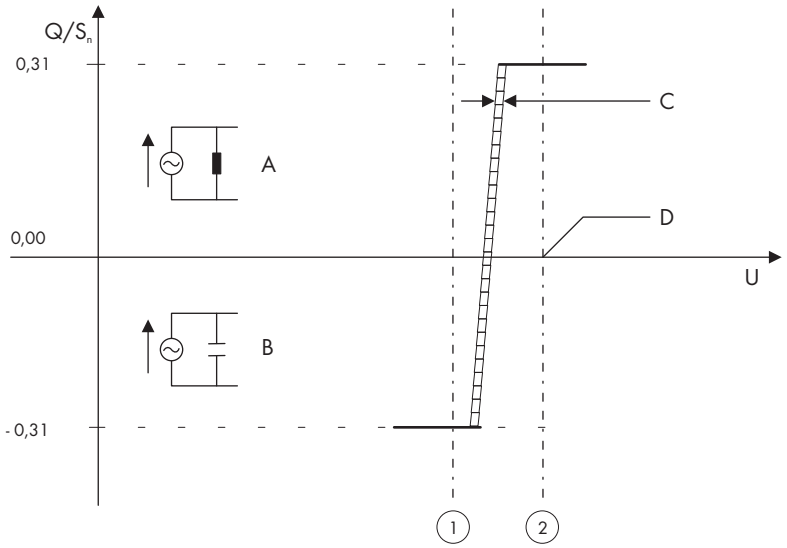


## 12.3 Reactive Power Dependent on Grid Voltage

In order to compensate for an increase of grid voltage during feeding at a grid connection point, a reactive power can be fed dependent on the momentary grid voltage. The reactive power setpoint is set on the basis of a characteristic curve. Thus parameters can be used to regulate which voltage change produces which change of the reactive power.

To avoid several systems interfering with each other with this function, a delay time of 0 – 120 seconds can be set, during which a voltage change must be present before there is a change of reactive power feeding. Consequently, several systems attempt staggered compensation of the grid voltage at the grid connection point.

The values in the following illustration are examples only. The values depend on the chosen settings.




| Object | description |
|---|---|
| A | underexcited operation of the Sunny Central |
| B | overexcited operation of the Sunny Central |
| C | hysteresis |
| D | default voltage $U_{Q0}$ |
| 1 | lower limit of the voltage range |
| 2 | upper limit of the voltage range |

# 13 Grid Monitoring

The Sunny Central monitors the energy supply grid for cases where the adjustable limit values are either not achieved or exceeded. If the upper or lower limit values are breached for a relevant adjustable time, the Sunny Central disconnects itself from the grid for reasons of safety.

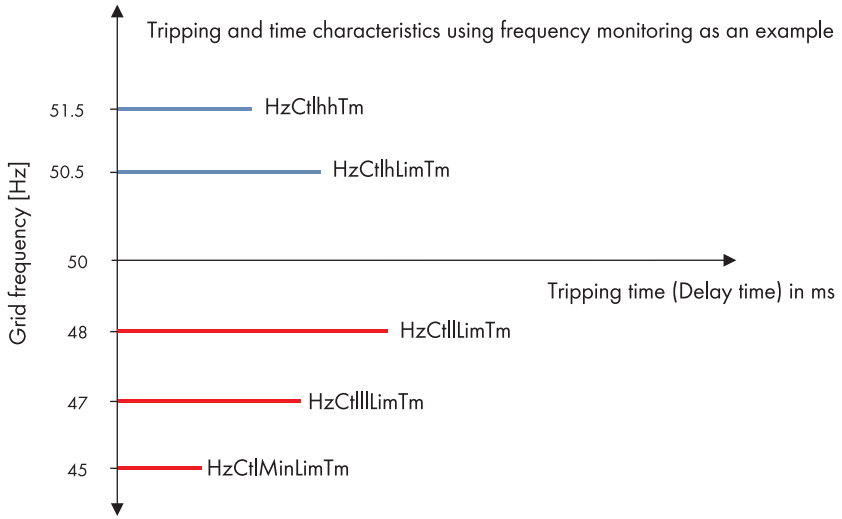
The following limit values are monitored:

- Voltage decrease protection U< and U<<
- Voltage increase protection U> and U>>
- Frequency decrease protection f<, f<< and f<<<
- Frequency increase protection f> and f>>

For every limit value, you can set a trigger delay time, during the period of which the grid fault must be present, before the Sunny Central disconnects itself from the grid.

This way, for example, activation can take place after 1 second at an overfrequency of 50.5 Hz, but after only 0.1 seconds at an overfrequency of 51.5 Hz.

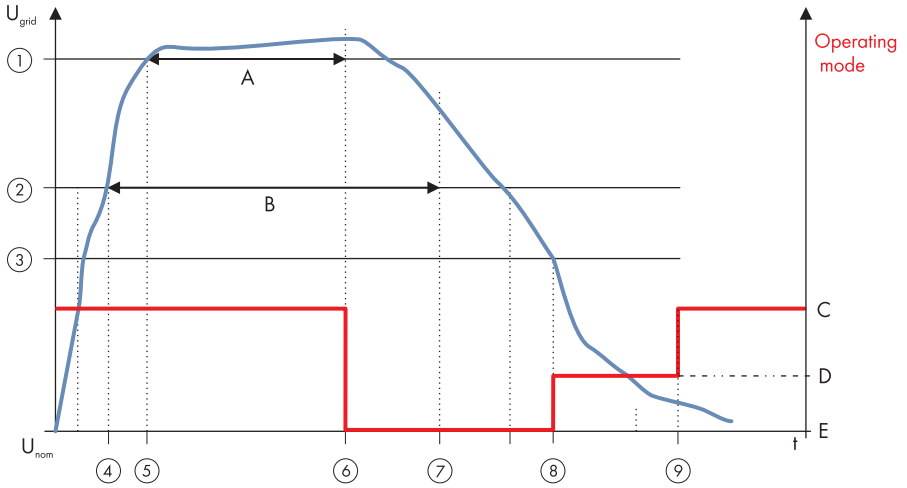
You can preset the limit values and the tripping time manually. For voltage monitoring, 2 limits can be set for both overvoltage and undervoltage. For frequency monitoring, 2 upper limits and 3 lower limits can be set.




## 13.1 Grid Connection after Error Clearance

Connection after clearance of a grid error only occurs after the grid voltage is back within the set limit value for the connection (e.g. VCtlOpMinNom), for the duration of the grid monitoring time (GriGrdMonTm).

## 13.2 Timed Behavior of Grid Limits in the Case of Breaches of Grid Limits




| Object | description |
|---|---|
| A | delay time for grid limit level 2 |
| B | delay time for grid limit level 1 |
| C | start up / MPP load operation |
| D | grid monitoring |
| E | disturbance |
| 1 | grid limit level 2 |
| 2 | grid limit level 1 |
| 3 | connection limit |
| 4 | grid limit level 1 is breached, timer starts |
| 5 | grid limit level 2 is breached, timer starts |
| 6 | grid limit level 2 for delay time level 2 is breached → grid disconnection |
| 7 | grid limit level 1 for delay time level 1 is breached → grid disconnection (the grid is already disconnected at level 2) |
| 8 | connection conditions fulfilled → monitoring time starts |
| 9 | grid within valid range during monitoring time → grid connection |

## 13.3 Setting the Medium Voltage Level

You can set medium voltage level for the display and grid monitoring. You can set the grid voltage to the appropriate value via the parameter "VRtg". The default value of the parameter "VRtg" is 20 kV. It is important that the transmission ratio of the external medium voltage transformer is adjusted at the same time. Here you only have to adjust the high voltage side via the parameter "TrfVolExlHi". The value must correspond to the value of the parameter "VRtg". The low-voltage side is already preset according to the specific device.

**Important: You always have to set the phase conductor voltages.**

## 13.4 Disconnection Protection Ramp (DCPRmp)

After a grid failure the Sunny Central slowly starts up again, with a disconnection protection ramp with maximum 10 % of the nominal power per minute. You have the option of switching this disconnection protection ramp on or off. If you switch the disconnection protection ramp off, the Sunny Central runs up to the maximum output in the shortest time possible.

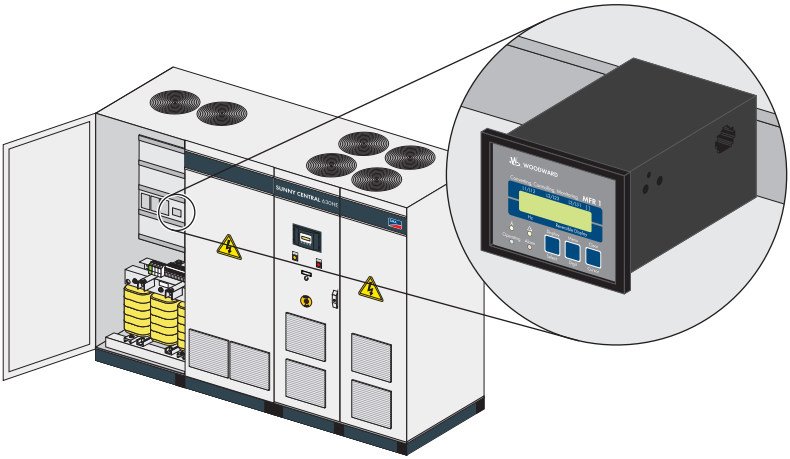
**Deactivating DCPRmp**

If you wish to deactivate the disconnection protection ramp, please consult the SMA Serviceline.

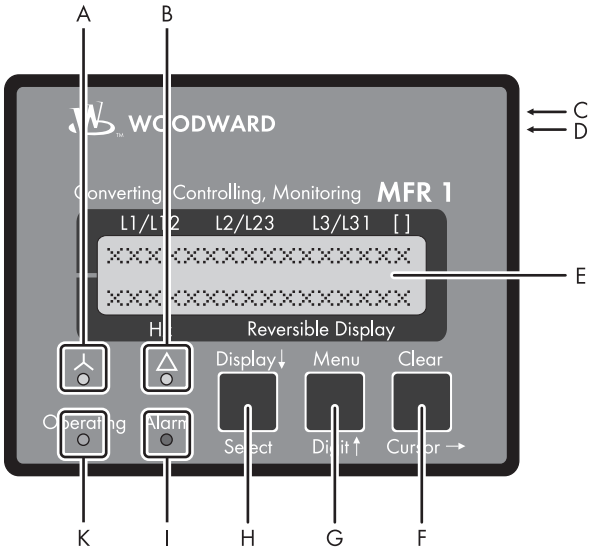
# 14 External Grid Monitoring Relay (Optional)

The Sunny Central has a integrated grid monitoring feature. As an alternative to the integrated grid monitoring feature, the Sunny Central can also be equipped with a separate grid monitoring relay. This relay monitors the grid, detects breaches of the grid limits and communicates a fault indication to the Sunny Central.

The position of the grid monitoring relay is depicted in the following illustration.



## 14.1 Overview of Display and Control Elements



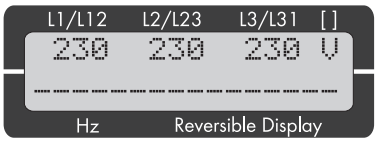
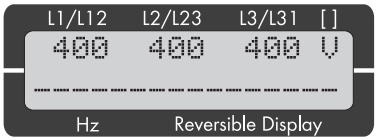

| Object | designation | function |
|---|---|---|
| A | Star | display of wye (star) voltages<br>(phase conductor - neutral conductor) |
| B | triangle | display of delta voltages |
| C | DPC socket | parameterization socket |
| D | potentiometer | sets the LED contrast. |
| E | LCD | 2-line LCD |
| F | clear | confirms alarm message |
| | cursor → | moves one position to the right |
| G | menu | selects a menu |
| | digit ↑ | increases selected digit |
| H | display ↓ | switches to next display |
| | select | confirms change |
| I | alarm | an alarm has occurred |
| K | operating | automatic mode |

## 14.2 Display Messages

Performance values can be monitored from the two-line display, provided that the grid monitoring relay is in automatic mode. The individual parameters are displayed in Parameter mode.

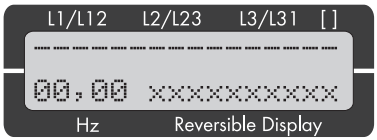
### Display in Automatic Mode, Upper Line: Measured Values

You can use the "Display ↓ " button to switch through the first line of the display.

| Display | description |
|---|---|
|  | The "Star" LED lights up and the "Triangle" LED is off.<br>The wye (star) voltages ($U_{L1-N}$, $U_{L2-N}$ and $U_{L3-N}$) of the four-wire system are displayed, |
|  | the "Star" LED is off and the "Triangle" LED lights up.<br>The delta voltages ($U_{L1-L2}$, $U_{L2-L3}$ and $U_{L3-L1}$) of the 3-conductor grid are displayed. |

### Display in Automatic Mode, Lower Line: Measured Values

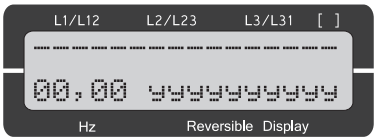
You can use the "Menu" button to switch through the messages displayed in the lower line.

| Display | description |
|---|---|
|  | the frequency [Hz] is displayed on the left in the lower line. |

### Display in Automatic Mode, Lower Line: Alarm Display

You can use the "Menu" button to switch through the alarm messages which have occurred.

Alarm messages are depicted in the lower line of the display on the right.



In the following table you will find a list of all of the alarm messages that the device can display.

| Alarm text | description |
|---|---|
| Overvolt. 1 | the threshold for the 1st level of the overvoltage monitoring has been exceeded. |
| Overvolt. 2 | the threshold for the 2nd level of the overvoltage monitoring has been exceeded. |
| Und.volt. 1 | the threshold for the 1st level of the undervoltage monitoring has been exceeded. |
| Und.volt. 2 | the threshold for the 2nd level of the undervoltage monitoring has been exceeded. |
| Overfreq. 1 | the threshold for the 1st level of the overfrequency monitoring has been exceeded. |
| Overfreq. 2 | the threshold for the 2nd level of the overfrequency monitoring has been exceeded. |
| Und.freq. 1 | the threshold for the 1st level of the underfrequency monitoring has been exceeded. |
| Und.freq. 2 | the threshold for the 2nd level of the underfrequency monitoring has been exceeded. |

## Confirming Alarm

The grid monitoring relay signals an error / alarm by means of the "Alarm" LED.

You confirm an alarm by pressing the "Clear" button. Error conditions are distinguished as follows:

- **The error is still present:**

  You will not be able to confirm the error for as long as it is still present. The blinking "Alarm" LED on the control panel indicates that the alarm is still present.

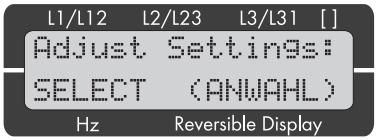
- **The error is no longer present:**

  If the present error has been rectified, then the flashing "Alarm" LED will switch to continuous illumination. The relay is configured in such a way that the error display is automatically reset after clearance of the error and expiration of a reset time.

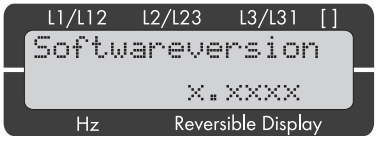
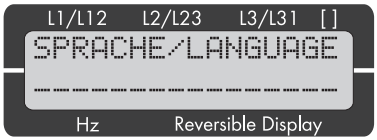
## 14.3 Configuration

You may not perform any configurations unless the Sunny Central is not in operation!

### 14.3.1 Switching from Automatic Mode to Configuration Mode

| | |
|---|---|
|  | **configuration mode "Select"**<br>Pressing the "Select" button activates the input mode and permits you not only to view the following screens but also to modify them within the specified limits. You can move the following screens forward by one screen by pressing the "Select" button. If you have configured a parameter to "OFF", then the associated screens will not be displayed and you will also not be able to edit them. You can move the display forward to the next parameter by pressing the "Select" button. |

### 14.3.2 Basic Settings

| | |
|---|---|
|  | software version |
|  | language selection: German / English |

## 14.3.3 Access for Configuration

### Password Protection

In order to be able to make parameter settings / adjustments, you will need a password. After this password has been entered, you will be able to view and modify all parameters.

The password is preset to <4753> at the factory.

You can change the password to one of your own selection. Store the password in a safe place in order to prevent unwanted parameter changes.

**DANGER!**

**Danger to life through changing the internal safety specifications of the Sunny Central.**

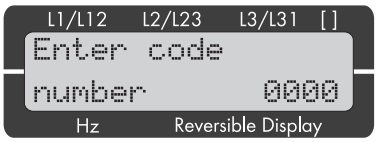
- Only qualified personnel are permitted to make changes to parameters.
- The SMA Serviceline must be consulted before making changes to parameters.

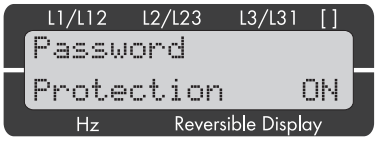
Once the code level has been set, it will not be changed, even after repeated entry into configuration mode. If an incorrect code number is entered, then the code level will be set to CS0, which causes the device to be blocked to outsiders.

If the supply voltage is uninterruptedly present at the relay for 2 hours, then code level 0 will establish itself automatically.

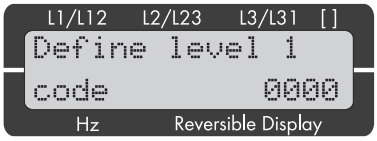
The configuration screen "Enter code number" appears only if the configuration screen "Password protection" is set to "ON".

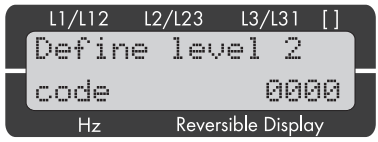
## Entering the Password

| | |
|---|---|
|  | enter code number 0000 - 9999<br>Input screen for the password |

| | |
|---|---|
|  | password protection ON / OFF<br>ON = Password protection is activated.<br>OFF = Password protection is deactivated. |

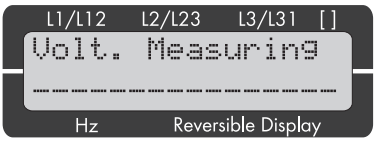
## Changing the Password

| | |
|---|---|
|  | establish password for code level 1<br>the password is preset to: CS1 = 0001 |

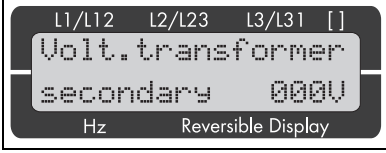
| | |
|---|---|
|  | establish password for code level 2<br>the password is preset to: CS2 = 4753 |

## 14.3.4 Measurement

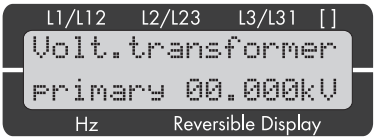
### Voltage Measurement

| | |
|---|---|
|  | **voltage measurement**<br>**four-conductor grid / three-conductor grid; default: three-conductor grid**<br>**do not alter** |

### Voltage Transformer Configuration

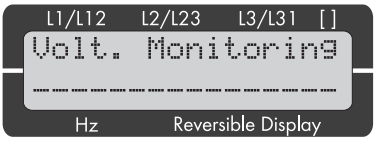
| | |
|---|---|
|  | **secondary voltage transformer**<br>**50 V to 125 V; Default 100 V**<br>preset, depending on the device**, do not alter.** |

Adjust the setting for the primary voltage transformer in accordance with the level of the medium voltage at your system. This setting has no effect on monitoring, but only on the display of voltage readings.

| | |
|---|---|
|  | **primary voltage transformer**<br>**00.100 kV to 65,000 kV; Default: 20 kV**<br>The primary voltage in kV is set here. This parameter is used for displaying the system voltage; **enter the voltage level of the medium voltage** |

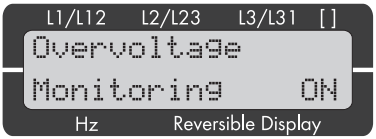
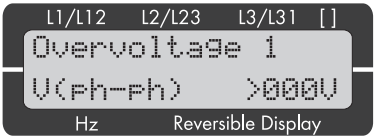
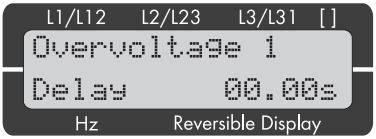
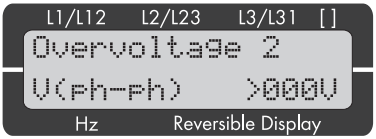
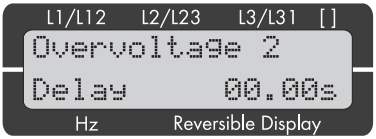
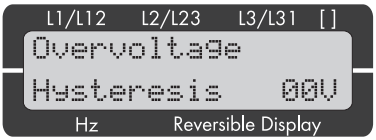
## 14.3.5 Monitoring

The relay can monitor either the phase voltages (four-conductor grid) or the phase conductor voltages (three-conductor grid). In the case of medium voltage systems, it is usually the phase conductor voltages which are monitored.

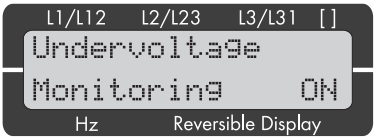
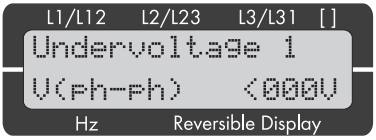
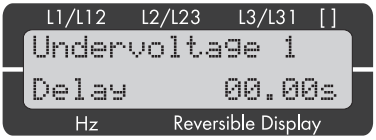
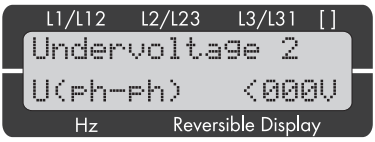
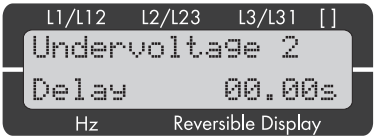
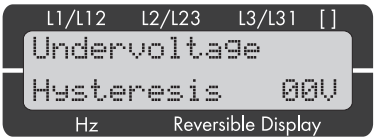
| | |
|---|---|
|  | Monitoring of ...<br>**four-conductor grid / three-conductor grid; do not alter** |

This parameter will no longer be displayed as soon as you have set the parameter "Voltage measurement" to three-conductor grid.

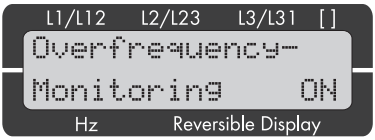
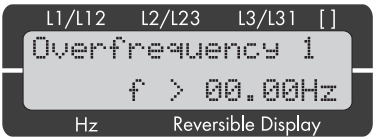
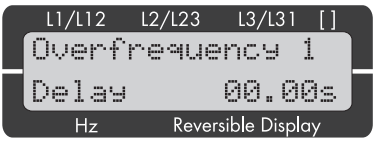
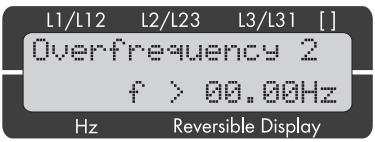
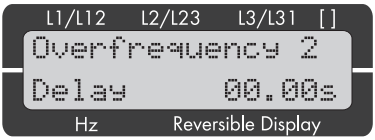
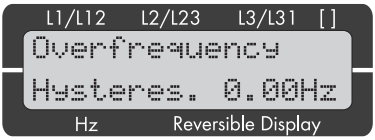
## 14.3.6 Overvoltage Monitoring

| | |
|---|---|
|  | **overvoltage monitoring ON / OFF**<br>ON = overvoltage monitoring is activated. The following parameters of this function are displayed.<br>OFF = overvoltage monitoring is deactivated. The following parameters of this function will not be displayed. |
| param. for **"3-conductor grid":**<br>  | threshold value for triggering with overvoltage in Level 1 |
|  | delay time for threshold value with overvoltage in Level 1 |
| param. for **"3-conductor grid":**<br>  | threshold value for triggering with overvoltage in Level 2 |
|  | delay time for threshold value with overvoltage in Level 2 |
|  | hysteresis for the overvoltage monitoring; this must be exceeded before any reconnection is possible. |

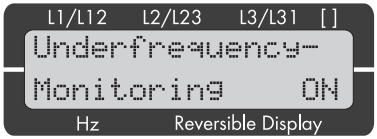
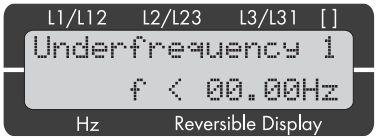
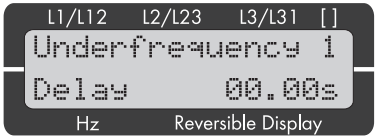
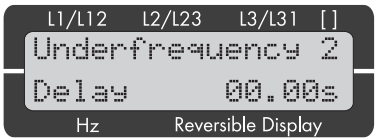
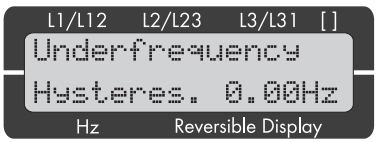
## 14.3.7 Undervoltage Monitoring

| | |
|---|---|
|  | **undervoltage monitoring ON / OFF**<br>ON = undervoltage monitoring is activated. The following parameters of this function are displayed.<br>OFF = Undervoltage monitoring is deactivated. The following parameters of this function will not be displayed. |
| param. for **"3-conductor grid":**<br>  | threshold value for triggering at undervoltage in Level 1 |
|  | delay time for threshold value at undervoltage in Level 1 |
| param. for **"3-conductor grid":**<br>  | threshold value for triggering at undervoltage in Level 2 |
|  | delay time for threshold value at undervoltage in Level 2 |
|  | hysteresis for the undervoltage monitoring; this must be exceeded before any reconnection is possible. |

## 14.3.8 Overfrequency Monitoring

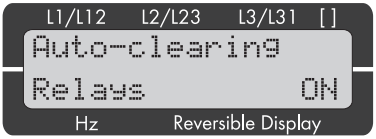
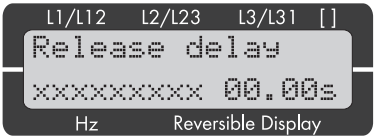
| | |
|---|---|
|  | **overfrequency monitoring ON / OFF**<br>ON = overfrequency monitoring is activated. The following parameters of this function are displayed.<br>OFF = overfrequency monitoring is deactivated. The following parameters of this function will not be displayed. |
|  | threshold value for triggering with overfrequency Level 1 |
|  | delay time for threshold value at overfrequency in Level 1 |
|  | threshold value for triggering with overfrequency Level 2 |
|  | delay time for threshold value at overfrequency in Level 2 |
|  | hysteresis for the overfrequency monitoring; this must be exceeded before any reconnection is possible. |

## 14.3.9 Underfrequency Monitoring

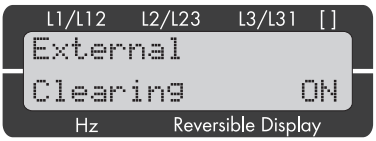
| | |
|---|---|
|  | **underfrequency monitoring ON / OFF**<br>ON = underfrequency monitoring is activated. The following parameters of this function are displayed.<br>OFF = underfrequency monitoring is deactivated. The following parameters of this function will not be displayed. |
|  | threshold value for triggering with underfrequency Level 1 |
|  | delay time for threshold value with underfrequency Level 1 |
| | threshold value for triggering with underfrequency Level 2 |
|  | delay time for threshold value with underfrequency Level 2 |
|  | hysteresis for the underfrequency; this must be exceeded before any reconnection is possible. |

## 14.4 Relay Configuration

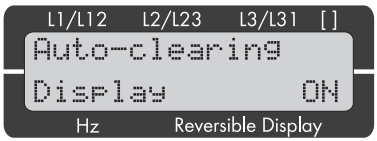
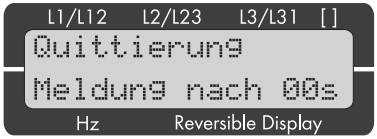
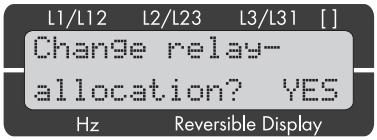
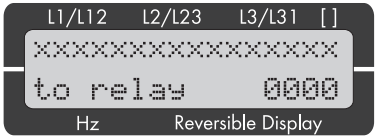
### Relay is Self-confirming

| | |
|---|---|
|  | **relay self-confirming ON / OFF**<br>ON = relay self-confirming is activated. The relays will be reset automatically if the error condition is no longer detected. How the display of the alarm messages is handled depends on the setting in the "**Self-confirming messages**" screen.<br>OFF = relay self-confirming is deactivated. The relays are reset by pressing the button.<br>How the display of the alarm messages is handled depends on the setting in the "**Self-confirming messages**" screen. The following screens of this function will not be displayed. |
|  | **fall-back delay of the relays 0.02 to 99.98**<br>the individual relays are resent when "Self-confirming relays" is activated and the monitored values have returned to within the permissible limits plus/minus hysteresis (in accordance with the monitoring) without interruption for at least the amount of time configured in this parameter. If the measured value exceeds/falls below the tripping value within this time frame, then the time measurement will be restarted. A fall-back delay can be configured for the following protective functions. |

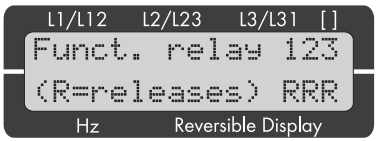
### External Confirmation

| | |
|---|---|
|  | **external confirmation of the relay via the digital input "Monitor / Remote Confirmation Blocking".**<br>**default: off**<br>**this function is not supported.** |

## Self-confirming Messages

| | |
|---|---|
|  | **self-confirming messages ON / OFF**<br>ON = once the alarm status is not longer detected, the message in the display will be deleted.<br>OFF = once the alarm status is not longer detected, the alarm message in the display will be remain in effect until it is confirmed manually. The following parameter of this function will not be displayed. |
|  | **fall-back delay messages 1 - 99 s / OFF**<br>active alarm messages will be confirmed once the delay time configured here has expired. This delay time begins as soon as the measured value exceeds/falls below the limit value plus/minus the hysteresis. |
|  | **alter relay allocation YES / NO**<br>this parameter enables one to select whether the relay outputs can be configured or not. See Parameter list<br>YES = this relay can be configured with respect to function and allocation. The following parameters are displayed:<br>NO = the relays are configured with the presettings. The following parameters are not displayed: |
|  | **allocate the protective functions to the Relays 0 to 3**<br>each digit in this parameter is used for the allocation of a relay to a protective function. Up to 4 relay outputs can be allocated a protective function. The relay can be configured as follows:<br>0 = if no relay is to be allocated to the protective function, then a "0" must be configured. None of the relay outputs energizes or drops out when the corresponding protective function triggers. If all 4 relay allocations are configured with a "0". A corresponding message will nevertheless be visible on the display.<br>1/2/3 = Relay 1 (terminals 9/10), relay 2 (terminals 11/12/13) and/or relay 3 (terminals 14/15/16) can be allocated the protective function with all of the devices. |

### Function of Relay

| | |
|---|---|
|  | **function of relays 1, 2 and 3 A / R**<br>the individual relays can be configured either as A = open-circuit current (closers) or R = standby current (openers).<br>A = the relay is configured as open-circuit current contact (closer / N. O.). The relay energizes only if the allocated protective function triggers.<br>R = the relay is configured as standby current contact (closer / N. C.). The relay is always energized and opens only if the allocated protective function triggers.<br>**INFORMATION:** Relay 1 is configured to R (opener / N. C.) and cannot be altered. |

## 14.4.1 Interface

A configuration interface is available for configuring the relay with the aid of a PC. A special interface cable (DPC) and software will be required for this purpose. For more detailed information, read the manual for the relay. This accompanies the Sunny Central on CD or you can find it on the Internet at www.woodward.com.

# 15 Islanding Detection (Anti Islanding)

In the event of grid failure, the grid voltage will drop. The Sunny Central detects this via the grid monitoring and switches off. In unfavorable circumstances there is the possibility that the Sunny Central is feeding the grid with a certain output, for example 100 kW, and the same grid branch is bearing a 100 kW load. This leads to the formation of an island grid and the Sunny Central supplies the 100 kW load. In the process the Sunny Central would measure its own voltage, which is equal to the grid voltage, and not immediately disconnect itself from the grid. If the Anti Islanding (islanding detection) function is activated, the Sunny Central detects the formation of an island grid and disconnects itself from the grid within a few seconds.

**DANGER!**

**Danger to life due to high voltages in the case of presumed disconnection from the grid. Death or serious burns.**

In a case as described above, voltage is present despite presumed disconnection from the grid.

- SMA Solar Technology AG recommends activating the "Anti Islanding" function.
- Contact the SMA Serviceline if you wish to have the "Anti Islanding" option activated.
- Always check that no voltage is present before working on the Sunny Central or the grid.

# 16 Low Voltage Ride Through (LVRT)

In the case of grid failure, the grid voltage can temporarily drop to 0 V. This generally leads to the Sunny Central disconnecting itself from the grid. With the LVRT option, the Sunny Central does not disconnect itself from the grid, but interrupts feeding for a maximum of 1.2 seconds and starts monitoring the grid. As soon as the grid voltage begins to rise again, the Sunny Central supports the grid by feeding it at the maximum level. The limit values for monitoring the grid are specified by the utility grid operator and/or state regulations. In the case of grid failures of longer duration, grid monitoring comes into effect, and the Sunny Central disconnects itself from the grid.

**Deactivating the LVRT Option**

If you wish to deactivate the LVRT option, please consult the SMA Serviceline.

# 17 Troubleshooting and Problem Solving

**DANGER!**

**Danger to life due to high voltages in the Sunny Central. Death or serious burns.**

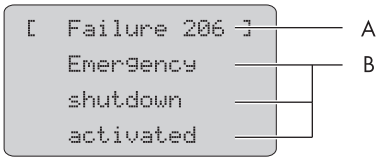
Even in the case of a failure the Sunny Central can still store high voltages.

- Only qualified technical personnel should perform any and all work described in this section. "Qualified" means that the personnel must possess training relevant to the activity performed.
- Work on the Sunny Central must only be carried out as described in this manual.
- Comply with all the listed safety instructions.
- All the safety instructions in the Sunny Central Installation Guide must be observed.
- If the fault cannot be rectified with the help of this manual, contact SMA Solar Technology AG as soon a possible.

If a disturbance occurs during operation, the Sunny Central will shut down and the fault will be displayed by the Sunny Central Control.

If several disturbances or warnings are present, the Sunny Central Control shows the fault which has the highest priority. It alternates between the standard view and the disturbance message.

A disturbance appears in the display as follows:




| Position | description |
|---|---|
| A | number of the disturbance or warning |
| B | reason for the disturbance or warning in plain text |

# 17.1 Fault Diagnosis

## 17.1.1 Categories of Disturbances and Warnings

The disturbance and warning numbers are allocated to different areas:

| Number | area |
|---|---|
| 100 to 179 | grid disturbances |
| 180 to 199 | grid warnings |
| 200 to 279 | Sunny Central hardware disturbances |
| 280 to 299 | Sunny Central hardware warnings |
| 300 to 379 | Sunny String-Monitor disturbances |
| 380 to 399 | Sunny String-Monitor warnings |
| 400 to 479 | power unit hardware disturbances |
| 480 to 499 | power unit hardware warnings |
| 600 to 699 | external warnings |

## 17.1.2 Types of Disturbances and Warnings

The Sunny Central disturbances and warnings are subdivided into 4 types:

| Type | description |
|---|---|
| error type 1 (Warning) | The Sunny Central does not switch itself off. Once the error is no longer present, the error indication is reset automatically. Check the system. |
| error type 2 (Disturbance) | Tthe Sunny Central switches itself off. Once the error is no longer present, the fault indication is reset automatically, and the Sunny Central starts up again. |
| error type 3 (Disturbance) | The Sunny Central switches itself off. Error type 3 only arises if the Sunny Central is feeding the grid when an error occurs. Once the error is no longer present, the fault indication is reset automatically, and the Sunny Central starts up again. |
| error type 4 (Disturbance) | Error type 4 must be confirmed before the Sunny Central can resume operation.<br>The Sunny Central switches itself off. Rectify the cause of the error, and confirm the error at the Sunny Central Control, or with Sunny Data Control. Once you have confirmed the error, the Sunny Central starts up again. |

## 17.1.3 Warnings

| No. | description | |
|---|---|---|
| 281 | **Error Text:**<br>Ground fault or SPD defect | **error text: 1** |
| | **Cause of error:**<br>The warning alarm chain is interrupted (see wiring diagram).<br>• Overvoltage protector damaged.<br>• Back-up fuse(s) damaged on the grid side or generator side (if present).<br>• The insulation resistance of the PV system is lower than the set threshold value.<br>• The transformer's biasing circuit breaker has tripped.<br>• One of the redundant power supply units is defective.<br>**Corrective measures:**<br>• Check fault signaling of the overvoltage protectors and replace them if necessary.<br>• Check the protectors' back-up fuse(s), and replace if necessary.<br>• Check the insulation resistance of the PV system.<br>• In the event of an insulation fault, check strings under load-free conditions. Separate and connect individual strings to determine which string is faulty.<br>• Check the function of the ground fault monitoring system.<br>• Switch the biasing circuit breaker of the transformer back on.<br>• Check the LEDs on the power supply unit and the monitoring module.<br>• Contact the SMA Serviceline. | |
| 283 | **Error Text:**<br>cabinet Temp. | **error text: 1** |
| | **Cause of error:**<br>The threshold value (parameter TMin or TMax) for the permissible cabinet temperature has been breached (too high or too low).<br>**Corrective measures:**<br>• Check function of cabinet cooling fans.<br>• Clean or replace soiled air filters.<br>• Check ambient temperature, and adjust it if necessary. | |
| 284 | **Error Text:**<br>Temperature sensor | **error text: 1** |
| | **Cause of error:**<br>External or internal temperature sensor is defective.<br>**Corrective Measure:**<br>• Check sensors. | |

| No. | description | |
|---|---|---|
| 380 | **Error Text:**<br>SMU | **error text: 1** |
| | **Cause of error:**<br>The string monitoring system has detected one or more faulty strings or surge voltage protectors.<br>**Corrective measures:**<br>• In the "Device Set-up > SMUs > Devices > Measured Values" menu, call up the individual string currents to locate the faulty string.<br>• More detailed information can be found in the Sunny String-Monitor manual. | |
| 381 | **Error Text:**<br>ser. com. with SMU disturbed | **error text: 1** |
| | **Cause of error:**<br>Communication disturbed between Sunny Central and the Sunny String-Monitors.<br>**Corrective measures:**<br>• Check communication lines and connections.<br>• More detailed information can be found in the Sunny String-Monitor manual. | |
| 382 | **Error Text:**<br>thievery solar panel | **error text: 1** |
| | **Cause of error:**<br>Signal loop for theft detection at the Sunny String-Monitor has been interrupted.<br>**Corrective measures:**<br>• Check string currents.<br>• Check signal loop.<br>• For further details, refer to the Installation Guide and User Manual of the Sunny String-Monitor or Sunny String-Monitor Cabinet. | |
| 601 | **Error Text:**<br>Defective default Effective power | **error text: 1** |
| | **Cause of error:**<br>The current value present at the analog input is not within the permitted range.<br>**Corrective measures:**<br>• Check the analog input. | |

| No. | description | |
|---|---|---|
| 602 | **Error Text:**<br>Defective default Reactive power | **error text: 1** |
| | **Cause of error:**<br>The current value present at the analog input is not within the permitted range.<br>**Corrective measures:**<br>• Check the analog input. | |
| 603 | **Error Text:**<br>Disturbed communication Effective power | **error text: 1** |
| | **Cause of error:**<br>The setpoint signal at the communication level is disturbed.<br>**Corrective measures:**<br>• Check the communication route. | |
| 604 | **Error Text:**<br>Disturbed communication Reactive power | **error text: 1** |
| | **Cause of error:**<br>The setpoint signal at the communication level is disturbed.<br>**Corrective measures:**<br>• Check the communication route. | |
| 680 | **Error Text:**<br>External Alarm was initiated | **error text: 1** |
| | **Cause of error:**<br>Dependent on the monitored unit.<br>**Corrective measures:**<br>Check the unit connected to the external alarm input. | |
| 681 | **Error Text:**<br>Reduction of effective power activated | **error text: 1** |
| | **Description:**<br>The Sunny Central momentarily reduces the effective power by means of an external target value. | |

## 17.1.4 Disturbances

| No. | description | |
|---|---|---|
| 104 | **Error Text:**<br>No Grid Synchronization | **error text: 3** |
| | **Cause of error:**<br>Left-hand rotating field or internal device fault.<br>**Corrective measures:**<br>• Check (right-hand) rotating field.<br>• Check whether all internal fuses are switched on.<br>• Contact the SMA Serviceline. | |
| 105 | **Error Text:**<br>Grid voltage too low | **error text: 2** |
| | **Cause of error:**<br>Voltage on the AC side is below the permitted range.<br>**Corrective measures:**<br>• Check the grid connections.<br>• Check grid stability. | |
| 106 | **Error Text:**<br>Grid voltage too high | **error text: 2** |
| | **Cause of error:**<br>Voltage on the AC side is above the permitted range.<br>**Corrective measures:**<br>• Check the grid connections.<br>• Check grid stability. | |
| 110 | **Error Text:**<br>UVW-Range | **error text: 2** |
| | **Cause of error:**<br>Voltage on phase L1, L2, or L3 outside the permitted range.<br>**Corrective measures:**<br>• Check the grid connections.<br>• Check grid stability. | |

| No. | description | |
|---|---|---|
| 111 | **Error Text:**<br>Grid frequency to high or to low | **error text: 2** |
| | **Cause of error:**<br>Grid limits breached.<br>**Corrective measures:**<br>• Check the display of the grid monitoring relay.<br>• Check the fuses in the load circuit. | |
| 112 | **Error Text:**<br>External Grid Monitoring triggered | **error text: 2** |
| | **Cause of error:**<br>Voltage or frequency on the AC side is outside the permitted range.<br>**Corrective measures:**<br>• Check the grid connections.<br>• Check grid stability.<br>• Check right-hand rotating field. | |
| 201 | **Error Text:**<br>Ground fault or Overtemperature | **error text: 2** |
| | **Cause of error:**<br>• The overtemperature disturbance chain is interrupted (refer to the wiring diagram).<br>• Switch cabinet overtemperature<br>• Transformer overtemperature<br>• Diode overtemperature<br>• The insulation resistance of the PV system is lower than the set threshold value.<br>• GFDI tripped<br>**Corrective measures:**<br>• Check the cooling fans for proper function.<br>• Clean or replace soiled air filters.<br>• Ambient or cooling air temperature too high.<br>• Check the insulation resistance of the PV generator.<br>• In the event of an insulation fault, separate and connect individual strings to detect the faulty one.<br>• Check the function of the ground fault monitoring system.<br>• Check GFDI (see additional documentation in the download are at www.SMA.de/en). | |

| No. | description | |
|---|---|---|
| 206 | **Error Text:**<br>Emergency shutdown activated | **error text: 4** |
| | **Cause of error:**<br>The device's own emergency stop was activated.<br>**Corrective measures:**<br>Unlock emergency and confirm disturbance, as described in section 17.2 "Confirm Error" (page 96). | |
| 209 | **Error Text:**<br>DC Short circuit | **error text: 4** |
| | **Cause of error:**<br>An internal short circuit was detected on the DC side within the inverter. The DC main switch was switched off.<br>**Corrective measures:**<br>• Check the Sunny Central from the outside.<br>• If possible, the Sunny Central should be externally isolated.<br>• Contact the SMA Serviceline. | |
| 215 | **Error Text:**<br>heat sink fan fault | **error text: 2** |
| | **Cause of error:**<br>• Motor overload switch for the fan(s) cooling the power module has tripped.<br>• Overtemperature protection for the fan(s) cooling the power module has tripped.<br>• Ambient or cooling air temperatures too high.<br>**Corrective measures:**<br>• Switch the motor overload switch back on.<br>• Check the cooling fans for proper function.<br>• Clean soiled air inlet or heat sink.<br>• Contact the SMA Serviceline if the error occurs frequently. | |

| No. | description | |
|---|---|---|
| 217 | **Error Text:**<br>DC CB tripped or door switch open | **error text: 2** |
| | **Cause of error:**<br>• The cabinet door was opened during operation.<br>• The DC disconnector was tripped due to an internal fault.<br>• The reverse current monitoring system on the DC side has tripped.<br>**Corrective measures:**<br>• Close the cabinet doors.<br>• Check the function of the door switches.<br>• Check the function and activation of the emergency stop relay.<br>• Check reverse current monitoring system.<br>• Contact the SMA Serviceline. | |
| 220 | **Error Text:**<br>Release- or Reset-Signal faulty | **error text: 2** |
| | **Cause of error:**<br>The release signal or confirmation signal of the inverter bridge is faulty.<br>**Corrective measures:**<br>Contact the SMA Serviceline if the error persists. | |
| 222 | **Error Text:**<br>Ambient temperature | **error text: 2** |
| | **Cause of error:**<br>The ambient temperature is higher than 51 °C.<br>**Corrective measure:**<br>• Check the cooling concept.<br>• Check the fans.<br>• Check the ambient conditions.<br>• Check the sensor. | |
| 400 | **Error Text:**<br>internal failure of inverter bridge | **error text: 2/3** |
| | **Cause of error:**<br>Internal inverter bridge disturbance (e.g. symmetry fault, board voltage, undertemperature, sensor breakage).<br>**Corrective measures:**<br>Contact the SMA Serviceline if the error occurs frequently. | |

| No. | description | |
|---|---|---|
| 402 | **Error Text:**<br>ser. com. with inverter bridge disturbed | **error text: 2** |
| | **Cause of error:**<br>• The RS485 communication between the inverter bridge and the Sunny Central Control is interrupted.<br>• The inverter bridge or the Sunny Central Control may be faulty.<br>**Corrective measures:**<br>• Check the RS485 wiring.<br>• Contact the SMA Serviceline if the error persists. | |
| 408 | **Error Text:**<br>PV Overvoltage | **error text: 3** |
| | **Cause of error:**<br>DC voltage is too high on the generator side.<br>**Corrective measures:**<br>• Immediately disconnect the PV generator from the Sunny Central! Danger of damage to the Sunny Central!<br>• Check DC voltage.<br>• Check module wiring and system design. | |
| 409 | **Error Text:**<br>IGBT Stack Temperature | **error text: 3** |
| | **Cause of error:**<br>Heat sink temperature is too high (software).<br>**Corrective measures:**<br>• Check the function of the inverter bridge cooling fans.<br>• Clean soiled air inlet or heat sink.<br>• Ambient or cooling air temperature too high.<br>• Contact the SMA Serviceline if the error occurs frequently. | |
| 410 | **Error Text:**<br>IGBT Stack Error Sum | **error text: 3** |
| | **Cause of error:**<br>Internal disturbance of the inverter bridge (e.g. DC overvoltage, overtemperature, defective driver, overcurrent).<br>**Corrective measures:**<br>Contact the SMA Serviceline if the error occurs frequently. | |

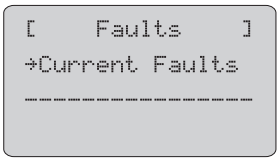
| No. | description | |
|---|---|---|
| 411 | **Error Text:**<br>IGBT-Overcurrent or UVW-Phase Error ADAPSCP | **error text: 3** |
| | **Cause of error:**<br>Internal disturbance of the inverter bridge.<br>**Corrective measures:**<br>Contact the SMA Serviceline if the error occurs frequently. | |
| 412 | **Error Text:**<br>Overcurrent | **error text: 3** |
| | **Cause of error:**<br>Internal disturbance of the inverter bridge.<br>**Corrective measures:**<br>Contact the SMA Serviceline if the error occurs frequently. | |
| 420 | **Error Text:**<br>ADAPSCP Overtemperature | **error text: 3** |
| | **Cause of error:**<br>Heat sink temperature is too high (hardware threshold)<br>**Corrective measures:**<br>• Check the function of the inverter bridge cooling fans.<br>• Clean soiled air inlet or heat sink.<br>• Ambient or cooling air temperature too high.<br>• Contact the SMA Serviceline if the error occurs frequently. | |
| 421 | **Error Text:**<br>ADAPSCP Overvoltage DC Voltage link | **error text: 2** |
| | **Cause of error:**<br>DC voltage is too high on the generator side (hardware threshold).<br>**Corrective measures:**<br>• Immediately disconnect the PV generator from the Sunny Central! Danger of damage to the Sunny Central!<br>• Check DC voltage.<br>• Check module wiring and system design. | |

## 17.1.5 Events

| Event | Explanation |
|---|---|
| > LVRT | LVRT (Low Voltage Ride Through) is active |
| > Netz-Parameter | adjusting the grid parameters |
| > NSM | Power limitation via NSM (grid security management) activated |
| < NSM | power limitation via NSM (grid security management) deactivated |
| > FRQ-Derating | power limitation activated via frequency |
| < FRQ-Derating | power limitation deactivated via frequency |

## 17.2 Confirm Error

1. Rectify the cause of the error.
2. Select "Operating Data > Faults > Current Faults".

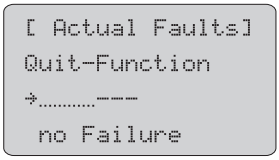



**Active Disturbance or Warning**

If a disturbance or warning is present, it is displayed with its date and time of occurrence.

3. Press [ENTER].
   ☑ The display begins to blink.
4. Press [ ↓ ] once.
   ☑ The word "quit" appears in the display.
5. To confirm the error, press [ENTER] twice.

☑ The error is confirmed. The message shown on the right appears in the display.



# 18 Contact

If you have technical problems concerning our products, contact the SMA Serviceline.

We require the following information in order to provide you with the necessary assistance:

- Type of Sunny Central
- Sunny Central serial number
- Type and number of the modules connected
- Type of communication
- Disturbance or warning number displayed
- Display message of the Sunny Central Control

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